

The

JANUARY, 1941

TOOL ENGINEER

MACHINERY • PRODUCTION • TOOLS

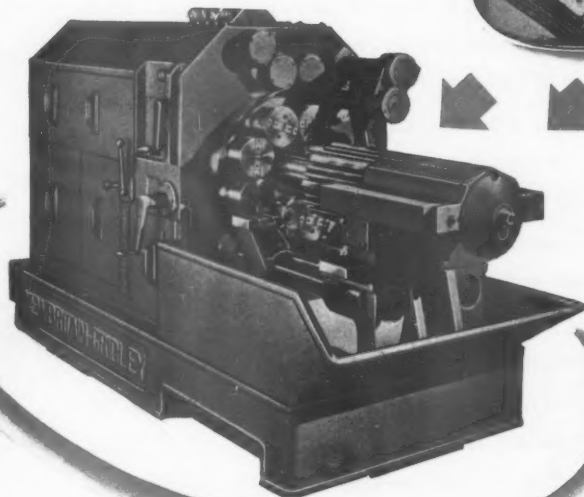
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STUB REAMERS



**The Decimal Size
you want
when you want it**

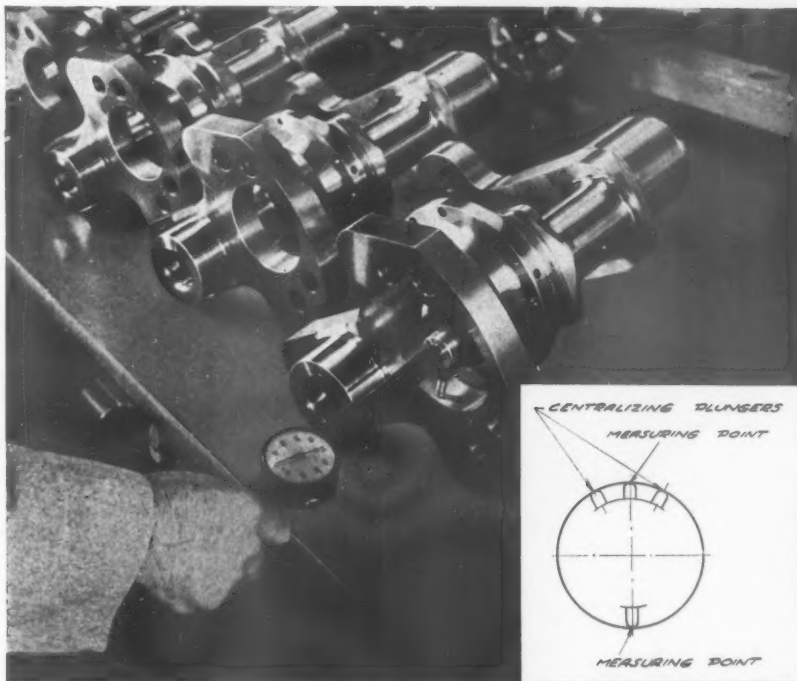
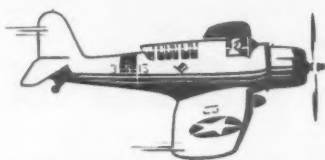


NEW needs are popping thick and fast . . . you can't plan production far in advance . . . so now, more than ever, you'll find Pratt & Whitney's rapid service on cutting tools a valuable aid. Many manufacturers today keep operations flowing smoothly by complete reliance on Pratt & Whitney for all stub reamer requirements. P&W maintains large stocks of standard blanks, already hardened, fluted, and shank ground. When your order arrives, these are quickly finished to the *decimal* size you need.

P&W Stub Reamers are high-speed steel, carefully heat treated for toughness and durability, low in cost, free-cutting. Ideal for jobs requiring short tools, or for use in floating holders. Complete range of sizes—.06" to 1.010" diameters. Ask about Pratt & Whitney Stub Reamers . . . in decimal sizes.

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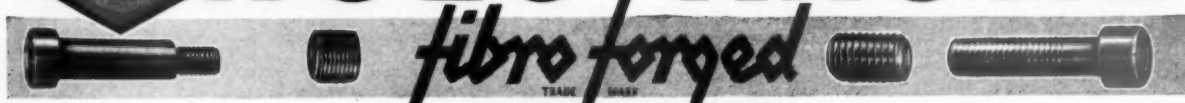
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THE HOLO-KROME SCREW CORP. **SOCKET SCREWS** HARTFORD, CONN. U.S.A.

THE TOOL ENGINEER

✓ R v. 10 pt. 1 Jan-June 1941

THE TOOL ENGINEER

"America in the Making"

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These are times when every productive second counts. Like other employers, you, too, now require the full time efforts of every skilled worker in the plant. Yet . . . production calls for faster . . . still faster action . . . and that's why DeWalt can help you.

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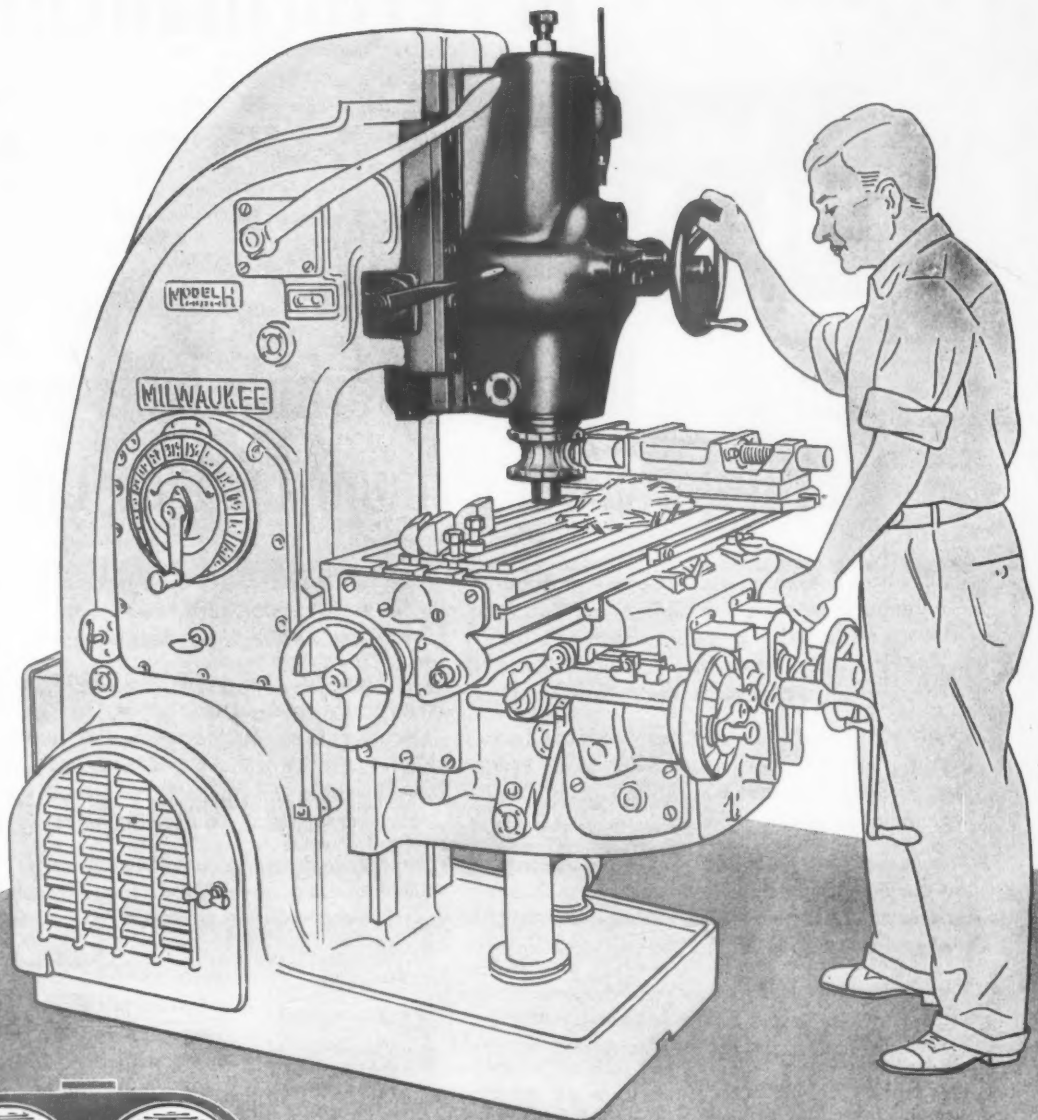
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THE TOOL ENGINEER

The spindles of Milwaukee Vertical Milling Machines have the same powerful drive as those of the horizontal models . . . with the spindle gears mounted solidly on the spindle. Thus power is delivered to the spindle through low torque, high speed shafts.

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**Vascoloy
RAMET**

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Tantalum-Tungsten Carbide Tools are Cutting Steel at a Lower Cost per Cut

You've been hearing a lot about bargains recently—bargains in price, in size, and grade! But very little about bargains in performance—the day-in-day-out performance that cuts steel faster—the performance that pays production profit!

In the big production industries where outstanding jobs of steel cutting are being done every day, you will find that Tantalum Carbide tools are doing the job.

This is because Tantalum Carbide possesses a low coefficient of friction—a lubricating characteristic which enables it to cut steel smoothly, easily, with longer tool life.

The majority of the steel being cut in many of these plants is being cut with Vascoloy-Ramet Tantalum-Tungsten Carbide Tools.

This isn't just a claim. It's a fact—a fact based on the factors which make Vascoloy-Ramet tools the best carbide tools obtainable.

These factors are basic research and raw material control.

The Fansteel Metallurgical Corporation, parent company of the Vascoloy-Ramet Corporation, has devoted a decade to basic metallurgical research to improve carbide tools. It has the largest staff of scientists concentrating on this work of any organization in the carbide tool industry.

Fansteel is the sole American producer of Tantalum; one of the largest producers of Tungsten.

Scientific knowledge of these rare metals and the complexities involved in their proper blending, assure you carbide tools of superior performance.

Furthermore, the name Vascoloy-Ramet does not imply steel cutting alone. In addition to Tantalum Carbide, you will find in the Vascoloy-Ramet line, Tungsten Carbide, Tantalum-Tungsten Carbide, Titanium Carbide—all the combinations necessary to the cutting of all metals.

Back of all these fundamentals is the standing of the Vanadium-Alloys Steel Company; the engineering skill of the members of the Vascoloy-Ramet organization; and the experience of the leading tool manufacturers who can recom-

mend the proper grade of any Vascoloy-Ramet tool for any specific use. Their service is further amplified by an assurance of early delivery.

Send for this manual. Get further facts about Vascoloy-Ramet performance.



VASCOLOY-RAMET CORPORATION

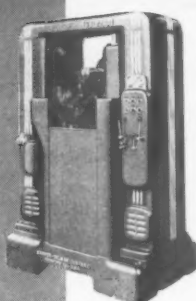
an affiliate of
North Chicago, Illinois
VANADIUM-ALLOYS STEEL COMPANY
and
Pittsburgh, Pennsylvania
FANSTEEL METALLURGICAL CORPORATION
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Factory Owned Branches: Jersey City, Detroit, Cleveland, Pittsburgh, Cincinnati, Hartford, Providence, Philadelphia.
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Let Barber-Colman Work With You..

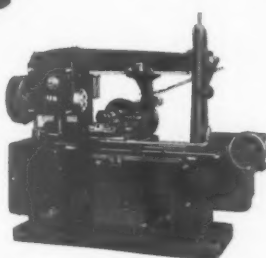
TO SPEED PRODUCTION, HOLD ACCURACY, CUT COSTS

Hobbing Machines..

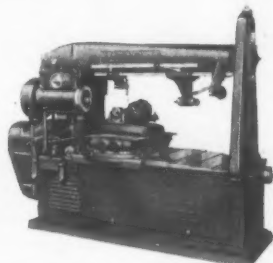


Type V Vertical Hobbing Machine. For accurate high production hobbing. Requires small floor space. Capacity: 8" diameter, 9" face.

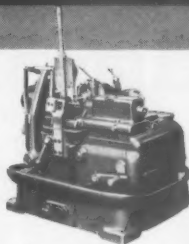
Outstanding for accuracy, high production and easy operation; Barber-Colman Hobbing Machines have an exceptional record of accomplishment on many kinds of work. They represent the latest developments in hobbing; are made in six sizes and types ranging in capacity from 1" diameter by 1/2" face, to 14" by 14". They save time, cut costs, and meet widely varied requirements.



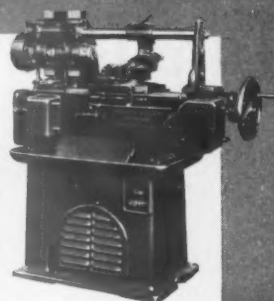
Type A. For general purpose and production hobbing. Capacity: 12" diameter, 12" face.



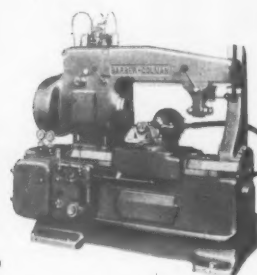
Type T Taper Spline Hobbing Machine. Also does general hobbing within capacity.



Type S Automatic Hobbing Machine. For mass production of precision small gears.

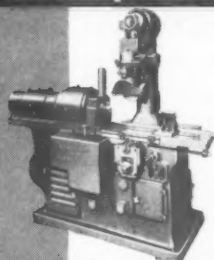


No. 3 Standard Hobbing Machine. Capacity: 5" diameter, 7" face. Also built in Precision Type.



Type D Hydraulic Hobbing Machine. For heavy-duty high production. Capacity: 14" diameter, 14" face.

Sharpening Machines..



No. 4 Automatic Hob Sharpening Machine.

Barber-Colman Sharpening Machines make correct sharpening easy, economical; reproduce original accuracy and efficiency on straight or spiral teeth.

B-C Automatic Sharpening Machines handle all makes of hobs and formed cutters; No. 3 sharpens up to 4" diameter by 4" face; No. 4, illustrated, sharpens up to 10" diameter, 12" face. B-C Combination Sharpening Machine sharpens reamers, hobs and cutters of all makes, in a wide range of sizes; has manual operation, positive mechanical control. B-C Reamer Sharpening Machine is designed for quantity sharpening of B-C Reamers exclusively.



Combination Sharpening Machine. Ideal for mixed lots of hobs, reamers, cutters; highly precise, simple to use.

Hobs..Cutters..Reamers..



Barber-Colman Ground Hob.

Hobs

Use B-C Ground Hobs for highest accuracy, finest finish, greatest value; B-C Unground Hobs for commercial limits, low first-cost. Standard or special.

B-C Hobs, "Paraform" Cutters, and Reamers are leaders in profitable performance and reliability. B-C cutter engineers, skilled workmen, and complete specialized facilities maintain unexcelled service.

Reamers

B-C Fluted and Inserted Blade Reamers have unique features which produce fine work fast.

"Paraform" Milling Cutters

Unsurpassed for rapid, accurate milling. All have B-C high quality, distinctive tooth form, long effective life.



B-C "Paraform" Staggered Tooth Side Mill.

Engineering Service..

Barber-Colman hobbing and cutter engineers constantly solve production problems for manufacturers in many different lines. Their extensive experi-

ence is available, without obligation, to develop applications of Barber-Colman products that will increase your output and profits.

Barber-Colman Company

General Offices and Plant 213 Loomis Street, Rockford, Illinois, U. S. A.



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MACHINES, HOB
SHARPENING MA-
CHINES, REAMERS,
REAMER SHARP-
ENING MACHINES,
MILLING CUTTERS,
SPECIAL TOOLS

AFTER THE ARMAMENT PROGRAM—

What?

THE answer to this question becomes increasingly clear: Whatever else happens, from now on, this country will face new competition from those nations who are employing our own mass production methods—whose industrial capacity will become a more serious threat than ever before.

If we are not to be outstripped, America must make still better products, still faster, at still lower cost. To do this requires the re-tooling of American industry. That's a big job and it will take years. But we've started!

Here at Gisholt, production facilities have been virtually doubled. Our research and engineering staffs are working day after day, searching out new facts, adding new refinements to obtain greater speed and accuracy in the turning of metals.

We are making sure that Gisholt Turret Lathes, Automatic Lathes, and Balancing Machines will contribute their full share to the American idea of creating more goods for more people at lower cost.

For therein lies the success of our economy.



No turret lathe more than five years old can compete with the speed and accuracy of this new Gisholt 2L High Production Machine. New advancements make it possible for this machine to reduce time and cost as much as 50% on many parts.

This rapid progress will continue. Today machine tools are not used until they wear out, but only until new developments have made them obsolete.

Look ahead—keep ahead—with Gisholt improvements in metal turning

GISHOLT MACHINE COMPANY

1229 East Washington Avenue
Madison • Wisconsin



TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

IS THERE A DOCTOR IN THE HOUSE ?

Yes Sir! Graphitic Steel is the doctor for your tool and die ailments. It's unexcelled for its ability to resist abrasion and wear.

There are five grades of Graphitic Steel—Graph-Al, Graph-M.N.S., Graph-Mo, Graph-Sil and Graph-Tung. They can be worked into any shapes or sizes and respond readily to heat treatment. They have the free machining qualities of cast iron and the high strength of steel.

Let us tell you more about this money-saving, time-saving new steel. Consult us without obligation.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO
Steel and Tube Division

TIMKEN
ALLOY STEELS

Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; and TIMKEN Rock Bits.



THAT much of the "civilized" world is today living in lands where the light of freedom has been blacked out and more of it is threatened with such a fate is not news to you. Nor is it news that an aroused America is busily at work to keep that painter's dripping brush from our shores. It may seem strange that in such a year there should be held a Machine and Tool Progress Exhibition. You may think it a supreme case of fiddling while Rome burns, of conventioning while our liberty is at stake. . . . But such is not the case; for this is no ordinary Exhibition. Because there is a shortage of skilled men and of machines it is more important than ever that the available ones be used at capacity. Tool Engineers of America owe it to their country to keep themselves informed. This Exhibition is designed with that one purpose in mind; with the helpful cooperation of the exhibitors and several government agencies it is planned to increase the efficiency of Tool Engineers in meeting the special problems of the day to such an extent as to far more than offset the time lost in attendance. . . . Designed to aid in accomplishing this goal are two special issues of THE TOOL ENGINEER which will be widely heralded by their readers. In March we offer a Show Number incorporating highlights of the exhibits and other special information to aid the showgoer in planning his program before attending and in getting the most out of it while there. This issue will also serve as an excellent substitute for the Show for those Tool Engineers who cannot possibly get away to attend. . . . This will be followed in April by an issue of particular significance devoted to "Tooling for Defense." Those who have been privileged to see the preliminary line-up of authoritative speakers and pertinent subjects planned for the technical meetings held during the Exhibition know how valuable they will be. These will serve as a backbone around which the "Tooling for Defense" issue will be built. There will be special sections upon Aircraft, the Navy, and other specialized problems of defense. This issue will be a valuable reference for every production executive throughout this emergency. . . . Together these two special issues provide a "double-barrelled salvo" no reader and no advertiser will want to miss. They have not been undertaken until there was every assurance that they would contain material of real and permanent value to the reader. They are sincerely designed with a view to helping Tool Engineers in their task of Defense Production to the end that there may never be a blackout in America.



Portrait of a Blackout

by A. Hitler



The Spotlight's on OMEGA

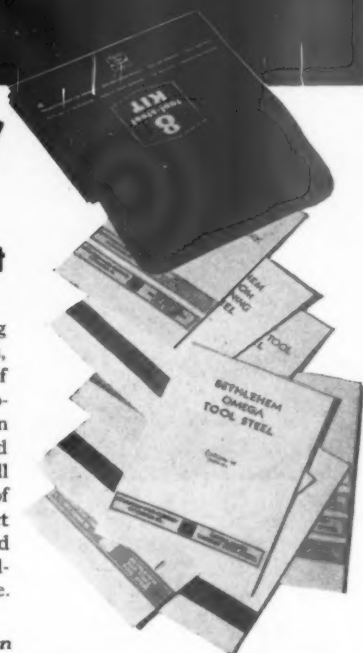
The "Shock-resister" of Bethlehem's 8 tool-steel kit

Bethlehem's 8 tool-steel kit offers you a compact set of tried-and-proved tool steels that will handle 90 per cent of the jobs in any shop. By using this group of steels you can cut inventories, simplify heat-treatment, and develop standard practices which will save time and produce better finished parts. Each steel in the 8 tool-steel kit is an outstanding performer in its own right.

For Example

Omega is Bethlehem's answer to the call for super-shock-resistance in tool steel.

This steel is an old standby in beading tools, pneumatic chisels, calking tools, punches, dies, heading tools and a host of similar applications. Omega can be economically forged and heat-treated. When oil-quenched at 1600 deg. F. and tempered at 450 deg. F., Omega develops a Rockwell hardness of C59, a tensile strength of 340,000 p.s.i., and a torsional impact value of 108 ft. lbs. This steel has earned a nation-wide reputation for long dependable service in all types of impact service.



Write to Bethlehem Steel Company, Bethlehem, Pa., for detailed information on the 8 tool-steel kit. We'll send it without any obligation on your part.

BETHLEHEM STEEL COMPANY





Is "Waiting For Big Machines" Stifling Your Production?



STANLEY CONTOUR GRINDER, priced only \$69.50, handles scores of accurate grinding operations. For making templates, grinding dies, finding blanks, correcting hardening distortion . . . handling regular production.



High-speed $\frac{3}{8}$ h.p. motor under the table of the Stanley Contour Grinder tilts to 45° . This tool takes the place of a large grinder, or eliminates slow hand work.

YOU'LL probably find that many jobs which are "waiting for big machines" can be done *right now* on one of the many Stanley Electric Tools. Ready for prompt delivery, these rugged, *low-cost* tools are built for regular production. Included are: Stanley Unishears, for rapid, accurate cutting of sheet materials; Tool-room, Flexible Shaft and heavy Portable Grinders, Electric Hammers, Drills and Saws. Don't miss an opportunity for fast, low-cost production. Ask your Stanley distributor to demonstrate, or write for literature. Stanley Electric Tool Div., The Stanley Works, New Britain, Conn.

STANLEY

Electric Tools

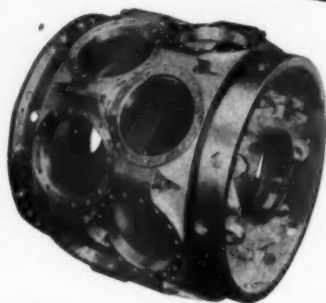


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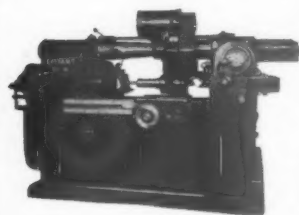
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IN YOUR SHOP EQUIPMENT

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10"	3' to 4 1/2'	15 3/4" to 33 3/4"
13"	4' to 7'	16" to 52"
14 1/2"	5' to 10'	24 1/2" to 84 1/2"
16"	6' to 12'	33 1/2" to 105 1/2"

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PROFIT PRODUCING



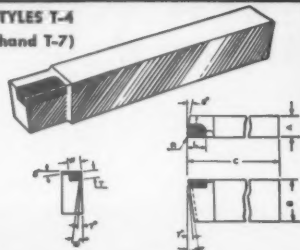
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SPRINGFIELD, VERMONT, U. S. A.

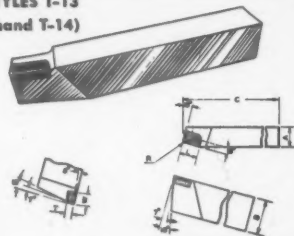
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AUTOMATIC DOUBLE-END MILLING & CENTERING MACHINES . . . AUTOMATIC THREAD GRINDING MACHINES
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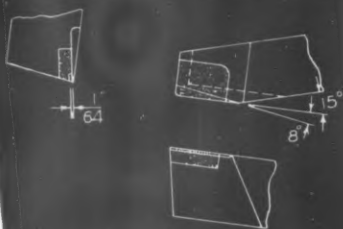
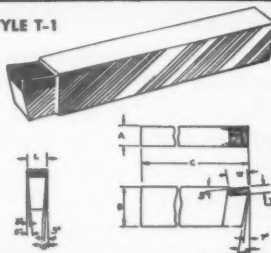
STYLES T-4
(left hand T-7)



STYLES T-13
(left hand T-14)



STYLE T-1



ALL STANDARD TOOLS ARE GROUND READY FOR USE

Steel Cutting Tools Styles 4, 7, 13, 14 have ground-in chip breaker as illustrated above.

Look for this triangular trade mark on tools you buy. It is your assurance of genuine Carboly cemented carbide.

Specify THESE **STANDARD**
CARBOLOY TOOLS!

SPECIFICATIONS—CARBOLOY STANDARD TOOLS

TOOL ORDER NUMBER						Shank Size		
Right Hand Style T-4	Left Hand Style T-7	Right Hand Style T-13	Left Hand Style T-14	Style T-1		A	B	C
T-42	T-72			T-12		1/8"	1/8"	2 1/4"
T-43	T-73			T-13		3/8"	3/8"	2 1/4"
T-45	T-75			T-15		1/2"	1/2"	3 1/4"
T-47	T-77			T-17		3/4"	3/4"	4"
T-48	T-78	T-137	T-147	T-18		1"	1"	4 1/2"
T-406	T-706	T-148	T-148	T-106		1 1/4"	1 1/4"	6"
T-140	T-710	T-1306	T-1406	T-110		1 1/2"	1 1/2"	7"
T-403	T-703	T-1310	T-1410	T-103		1 3/4"	1 3/4"	7"
T-404	T-704	T-1304	T-1404	T-104		2"	2"	7"

Vest pocket size 16-page instruction manual packed with each tool.



Standard grades supplied with these tools: Grade 78B for steel cutting. For cast iron, brass, etc., grade 44A and (for longer tool life on rigid set-ups) grade 883.

FOR "UNIVERSAL" SHOP USE ON 80% OF ALL STEEL, CAST IRON, ETC., TURNING, BORING, FACING JOBS

For fast delivery, maximum economy, easy ordering and simplified stocks, specify the new, recently announced Carboly Standard Tools.

Just five styles—in three grades—are designed for universal use on 80% of all turning, boring and facing jobs on steel, cast iron, brass, etc. Rapid grinding procedure permits grinding innumerable variations in each tool. Proper carbide grade

selection—often a problem—is practically automatic with these new standards. One grade for steel cutting; two for cast iron, brass, etc.

Take advantage of the new economies and broader uses now possible with Carboly Tools through these simplified design and grade selection features and the new low prices (approaching the price of ordinary tools). Write for Catalog GT-125.

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FOR CUTTING, DRAWING, SHAPING, EXTRUDING METALS AND NON-METALLICS • FOR REDUCING WEAR ON EQUIPMENT OR PRODUCTS YOU USE OR MAKE

Because *they* reduce the cost per piece machined—



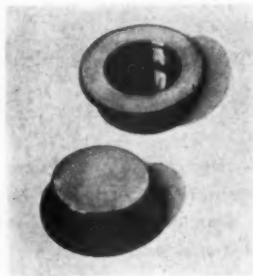
HAYNES STELLITE "J-METAL" CUTTING TOOLS are STANDARD on these *Steel Jobs...*



WHEEL HUB—Rough- and finish-turning and rough- and finish-boring the counterbore of a high-carbon cast steel wheel hub, with Haynes Stellite J-Metal cutting tools at a speed of 64.5 surface feet per minute with .017 in. feed for roughing and .009 in. for finishing.

BRAKE DRUM—Rough- and finish-turning a cast steel brake drum with Haynes Stellite J-Metal tools. The roughing speed is 91 surface feet per minute with $\frac{3}{16}$ in. depth of cut and $\frac{1}{32}$ in. feed per revolution. For finishing, the job is run at 261 surface feet per minute, with $\frac{1}{32}$ in. depth of cut and $\frac{1}{32}$ in. feed per revolution.

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These valve stem caps for diesel engines are made of Haynes Stellite alloy for resistance to heat and abrasion. Haynes Stellite specialties can be supplied—either rough or finished to your specifications—for use wherever abrasion, corrosion, or heat are encountered. Write for information.



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Red-hard, wear-resisting alloy of cobalt, chromium, and tungsten

STEEL GEAR BLANK — Rough- and finish-facing and boring a steel automobile bevel driving gear blank with Haynes Stellite J-Metal tools. Speed, 210 surface feet per minute. The steel is forged SAE-5120, of 143 Brinell hardness.

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Complete information about features, advantages, cycles and specifications of Number 0 and Number 1 Rigidmils is contained in Bulletins 382 and 383 shown above. Write for your copies today.

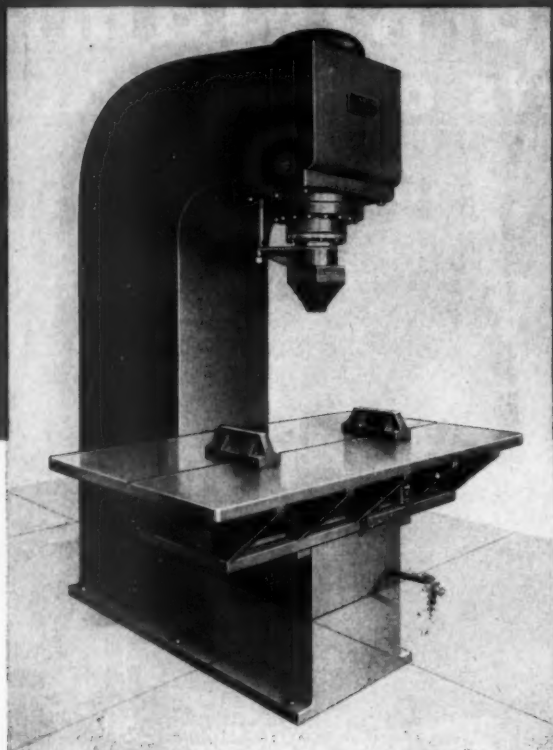


RIGIDMILS-STUB LATHES

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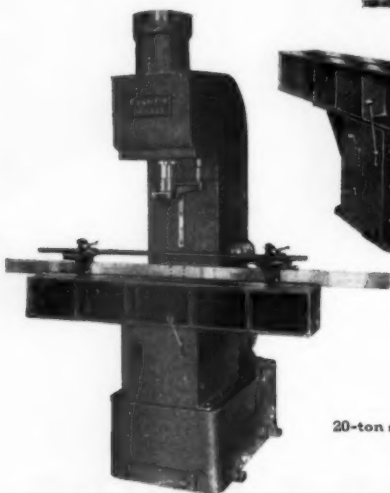
Finger-Tip Control

**MAKES
STRAIGHTENING OPERATIONS
EASIER TO HANDLE**



150-ton straightening press with large table. Base of press designed for installation below floor level.

75-ton straightening press with 36-inch reach. Straightening table removable for press-fit operations on lower table.



20-ton straightening press

The sensitive pressure control of this Hannifin hydraulic straightening press is so simple that the operator literally has any pressure up to full capacity of 150 tons available at a touch of the fingers. This new type of control gives an infinitely variable control of *ram pressures* by either hand lever or foot pedal. The initial lever movement gives a rapid approach stroke at nominal pressure. Further lever movement causes increasing ram pressure, up to full capacity. Release of the lever gives a rapid return stroke to top ram position. Because complete and sensitive control of ram pressures is so simple, handling of work is easier and accurate straightening operations can be carried on at rapid production rates.

Hannifin hydraulic presses are complete, self-contained units, with built-in motor driven hydraulic power. Many types are available for straightening, press-fit assembly, and similar work, in capacities from 5 tons to 300 tons; modifications in dimensions, speeds, and ram stroke are readily made to meet individual requirements. Consult Hannifin engineers, or write for descriptive literature.

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HANNIFIN Hydraulic Presses

No Bottleneck Here

AMONG the more conspicuous of American traits is a tendency towards fads. We take a song like "Who's Afraid of the Big Bad Wolf?" or "Six Lessons From Madame LaZonga" and sing it until we wish it had never been written; we take a game like "Miniature Golf" or "Chinese Checkers" and play it until we wish it had never been invented; and we take a term like "Bottleneck" and use it out of all reason until we wish it had never been coined.

At the moment we think the Machine Tool Industry has the best reasons for wishing the term bottleneck had never been applied to National Defense. At first it was clever, and people enjoyed talking knowingly of this or that being a bottleneck. *The New Yorker*, quick to give satire where satire is due, soon reduced the term to an absurdity through a cartoon by Charles Addams. Today well informed people who should know better have a tendency to generalize glibly that the Machine Tool Industry is a bottleneck.

Orators and writers always have been tempted to force facts and points into the rounded mold of the "well turned phrase." In the interests of accuracy we might better approach the problems of the day if we lay aside the glib phrase and the neat thrust.

Fact is that the Machine Tool Industry is no bottleneck.

It is true that the work of Tooling for Defense and the manufacture of the Machine Tools required takes time. So up jump the commentators and shout, "Bottleneck!"

We think not.

It took the United States Senate and the House of Representatives time—a long time—to get a Defense Program worked out and passed through both houses. Did everybody call that a bottleneck?

Several months elapsed after funds were finally voted before contracts in any large quantity were signed. Was that a bottleneck?

Some of these administrative delays were the result, in all probability, of petty politics or red tape; but many of them resulted from an earnest desire to do the job well.

In like fashion the task of Tooling for Defense is one which must be done well. The Machine Tool Industry and the Tool Engineer have risen admirably to the task. They are doing the job faster and better than in any other like emergency which has ever arisen.

And what thanks do they get?

They get called a bottleneck; they get blamed because people feel the Defense Program is bogging down; they are looked upon with a certain amount of contempt by laymen who feel they are "war babies" out to get everything they can out of this emergency.

Nothing could be farther from the truth. An heroic work is being performed in this emergency. It is true that there are points of congestion, but to say that the industry as a whole is a bottleneck is an unwarranted generalization. It implies a holding back on the reins, when in actuality the industry is doing everything possible to speed up the tooling process—to make this necessary time lag as short as possible.

It is the task of all of us who know the true situation to help correct false impressions. People must be made to realize that these essential tooling operations are not the bottleneck, but the backbone, of the Defense Program.

Unusual Set-up for "ACORN" DIES

This "Acorn" Die is finish-threading a special aeronautical valve of stainless steel. Accurate? Well, the $\frac{1}{2}$ "-20 thread must be so accurate that the threads of the High Speed produce smooth, perfect threads within extremely close tolerances. A full thread right to the shoulder was needed, too—another reason for the "Acorn" Die. & Not one manufacturer in a thousand will have an operation like this one. But the fact that only "Acorn" Dies could meet it is genuine proof of their extreme adaptability. & If you need fast threading, accurate threading or super-accurate threading, you need to know more about "Acorn" Dies. Any "G.T.D. Greenfield" Engineer is qualified to answer your most searching questions.

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The History of

Cast High Speed Steel

By L. C. GORHAM

President, Gorham Tool Company

CAST High Speed Steel is not a new tool material. As a commercially practical product, it is new. In fact, it is so new that very little information is available on its manufacture, properties, and uses. This article is intended to review briefly the historical background of Cast High Speed Steel and give an insight into its present development.

The use of the word "Cast" in describing this material is ambiguous inasmuch as all high speed steels are cast in the sense that they are solidified from the molten state in a mold. Ordinary high speed steels are poured in a molten state into an ingot mold, the size of which is established in relation to the ultimate size of the finished stock. The ingot is later reduced by forging to a billet. The billet may be cut up and forged into individual tool blanks or it may be processed by rolling and possibly drawing operations to the desired shape and size. This mill working is the thing that differentiates the ordinary high speed steels from Cast High Speed Steel. The latter is not mill worked. It is cast into individual tool blanks of whatever shape is desired or into bars or plates that are to be cut up into suitable blanks.

Freedom from mill working immediately suggests a cheaper material. This desire for less expensive tools was the driving force that instigated the earliest attempts to cast high speed steel directly into tool blanks but it also proved to be the stumbling block that spelled failure for the efforts. We can easily imagine how pleased the early investigators of this problem must have been at the prospect of casting a side milling cutter directly from the melt with subsequent operations limited to grinding to size and sharpening. The plain forging from which a 6 x 1 x 2 side mill is made weighs about eleven pounds. The completed cutter when brand new weighs only about five and one-half pounds. Besides the saving on material, which would be considerable even at the current quotation on high speed steel, there would be no need for turning and boring the blank or milling the teeth. This was a pretty picture and it is no wonder that much time and

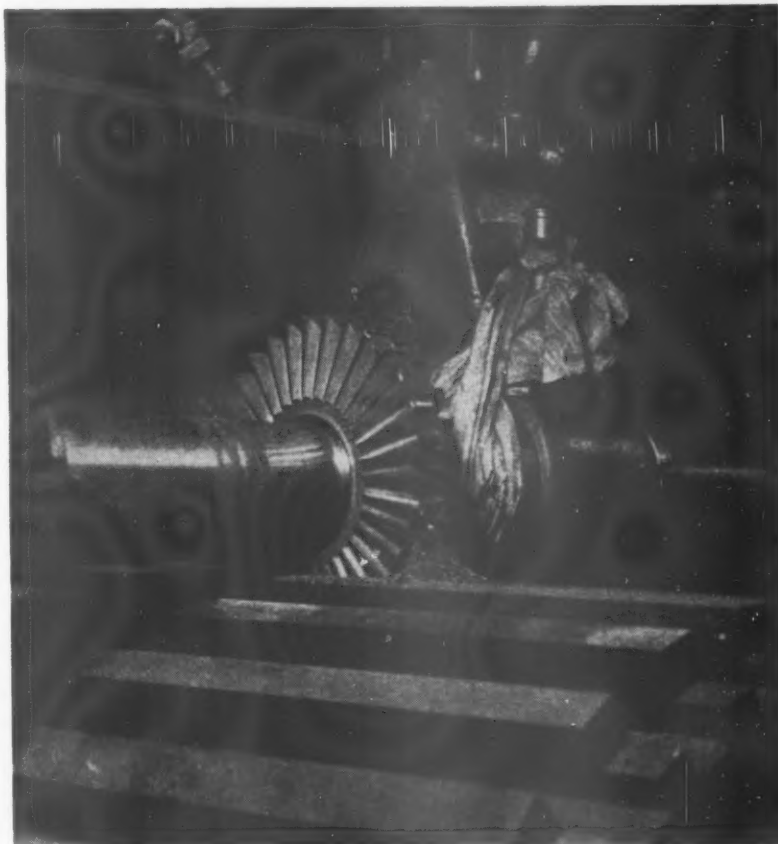
Recent developments in cast high speed steel make it a practical tool material of unusual interest

money was spent in trying to hit this illusive jack-pot. In striving for a cheaper product, certain fundamentals were overlooked that led to erratic performances of the completed tools and the producers of the material fell by the wayside.

A state of war raises havoc with many things, among them the price of high speed steel. During the World War we were practically dependent on tungsten high speed steels for our tool materials.

Tungsten was not a domestic product, hence was at the mercy of the world market and soared in price as the procurement of the virgin metal became increasingly difficult. The price of high speed steel was raised accordingly as those who were active in production during those years can well remember. Here was a fertile field for the introduction of a cheaper tool material, resulting in the production of Cast High Speed Steel on a commercial basis for the first time.

The pioneers in this work were essentially foundry men whose main interest was to produce sound castings of the complex alloy of high speed steel. In



A cast milling cutter slotting beater roll for paper mill.
Production time reduced from 56 hours to 11 hours for 26 slots.



Pouring bushing in spinning mold.
"It has not been possible..."

this aim, they succeeded quite well but they did not have the necessary experience in the field of metallurgy or in the actual design and use of tools made from their castings to carry the project to a successful completion. In justice to them, we must remember that twenty years ago they did not have access to the fund of metallurgical information now available. They were limited in the analysis they chose to cast to the only analysis of high speed steel which at that time had any acceptance. This was the familiar 18% tungsten, 4% chromium, 1% Vanadium type which remains as the most widely used analysis but is not suitable for direct casting production. Their melting equipment and technique were comparatively crude when judged by present standards. Heat treating and testing equipment suitable for the peculiar requirements of this new field were not to be had. We can now sit back and marvel that any progress at all was made in the face of such handicaps.

Originally Cast in Sand

The Cast High Speed Steel of this period was melted in an electric furnace and cast directly from the ladle into sand molds prepared from patterns just as iron castings were made. The castings were formed as required by grinding. The casting operation set up a hardness that prevented machining operations such as turning and milling. Following the grinding to the desired shape and size, the tools were heat treated to bring out the desired physical properties. The literature of this period records the fact that some of the tools produced in this way out performed ordinary high speed steel tools by as much as two to one but no definite production records are available.

The fact that this material was not annealed was a big handicap and prevented a much wider use of it. The procedure foremost in the field of casting high speed

of casting tools in molds that were of the final shape desired, except for the addition of grinding stock, was economical only when quantities of the individual castings were required. A pattern cost was spread over the number of castings from each pattern. If the number of castings desired was low, the pattern cost was excessive per finished tool, throwing this material out of competition with other tool materials. Grinding equipment and technique were not developed to the point where it was as economical to grind a hard blank to shape as it would have been to machine an annealed blank.

Sound and uniform castings of high speed steel have always been difficult to produce. Questions of melting practice, pouring temperature, mold design and mold temperature all complicate the problem even after an analysis that lends itself to direct casting has been developed. It is no wonder that many defective cast tools were produced during the first attempt to commercialize this process. Some of these defective tools did not indicate their defects until they were put to work in customer's plants. Such failures could only result in the entire field of Cast High Speed Steel falling into general disrepute.

Cutting tools at that time were designed almost without exception to be made of forged high speed steel. Cutting edges were not backed up sufficiently to permit the use of a tool material that did not have the strength of the forged steel. Had those men who pioneered Cast High Speed Steel been tool makers, they would probably have become aware of the necessity of redesigning the tools they were making to suit the strength limitations of the cast material. A more rugged design would have decreased the casting hazard as well as strengthened the tool in service and would have given the cutting edges a chance to perform their work without the breakage and chipping that was characteristic of so many of the early cast tools. In actual ability of the cutting edges to stand up under a cut, these castings proved superior to the forged tools then in use. But cutting edges must be backed up for mechanical strength and for conduction of the heat generated by the cut away from the actual cutting portion. The handicap of using a design lacking in these elements contributed to the failure of cast tools.

In spite of the many difficulties encountered, the production of Cast High Speed Steel tools became quite an industry during the last year of the World War and for several years following. In 1920, the United States High Speed and Tool Company at its Green Island plant had foundry capacity for casting seven tons of blanks per day. Even today, this would be a lot of steel and is indicative of the large amount of cast tools then offered to the trade. This concern was the

steel and similar heavily alloyed analyses. Unfortunately, difficulties within this organization prohibited the experimental work that might have led to a successful marketing of cast tools. The demands of industry for cutting tools dropped off radically following the cessation of hostilities. Tungsten once more was easily obtained with the result that the price of forged high speeds resumed its pre-war level. Users of cutting tools were satisfied to use tools of forged material on the limited production necessary following the heavy demands of war time. The production of Cast High Speed Steel died a natural economic death.

Cast High Speed Fills Gap

During the past ten years production demands on tools have steadily increased. The use of alloy steels on production parts has forced the development of suitable tooling. The machining of the new plastics and new non-ferrous materials



Removing bushing from cast.
"...to envision all..."

challenges the tool manufacturer to greater endeavors. Even cast iron, which was always considered as one of the easiest materials to machine, has been alloyed in many instances to the point where the working of it is a real problem. The current armament program is at the mercy of the tools that are required to speedily machine materials with which we have had practically no high production experience.

Tool steel producers and tool makers have not been lax in answering this call for better tools. In the field of high speed steels, so many new analyses have been offered on the market that much confusion has resulted. The past decade has seen a steady increase in the use of molybdenum and molybdenum-tungsten high speeds. Cobalt bearing analyses have come into their own on operations where the red hardness qualities of cobalt additions are beneficial. Improved mill and

heat treating methods and equipment are certain to raise the production abilities of the forged high speeds but it does seem that the number and variation of analyses now available well covers the possible field of applications.

Many new features have been offered in the line of non-ferrous tool materials, such as the improved Stellites. These have no annealed state, hence are limited to use where this objection is not important. Many wear resisting applications as well as cutting tools are well handled by these types. The ease with which these alloys may be laid on in welding operations is particularly attractive.

A definite gap exists between the field of economical application of forged high speed steels and the field of economical application of carbides. This gap has become increasingly apparent in the machining of hard and tough materials used on armament work. American manufacturers are being called upon to machine on a production basis parts made of materials which have never before been required in sufficient quantities to demand large production tooling. The material specification and design of many of these parts is such that they are not readily machined with forged high speed tools and yet it is not economically feasible to machine them with carbides. This situation has brought the gap existing between the applications of these tool materials to the attention of production men faced with the necessity of machining unfamiliar parts on high production.

Producers of tool material have been aware of this gap to which none of their products is entirely suited. There is a limit to which forged high speeds can be alloyed. Beyond this limit, they are no longer forgeable commercially, hence cannot be mill worked. The super high speed steels that have been on the market for some years are alloyed as high as is commercially possible with the aim of producing a steel with a maximum of red hardness, toughness and resistance to abrasion and still have an analysis that may be produced by the usual mill methods. Attempts to fill this gap with cemented carbides have gone a long way in extending the application of carbide tools but have not been completely successful as was indicated previously in this discussion.

The introduction of molybdenum high speed steels brought with it the problem of heat treating on a commercial basis. Heat treating departments not equipped with controlled atmosphere furnaces or salt baths generally used borax as a coating for the tools during heat treating to prevent decarburization. The answer to decarburization seemed to be in the development of an analysis of molybdenum high speed steel that could be heat treated in ordinary furnaces without decarburization. Since borax was used as a protective coating, the thought came to

mind that the addition of boron to the steel itself might have the same effect. It was known that boron carbide is the hardest of the carbides, hence it was felt that a boron carrying high speed steel might be expected to have superior physical properties as well as resistance to decarburization. This proved to be a correct assumption. As a result of this work, two molybdenum high speed steels with boron additions are now manufactured commercially. Both are forgeable and are produced in regular mill routine. In the field for which they were developed, they have both given outstanding results but they are a side issue of the theme of this article.

Suitable Analysis Developed

Attempts to alloy a boron carrying high speed steel to produce the ultimate physical characteristics possible in steel of this type led to interesting results. Heats were made that gave promise of having desirable properties when fabricated into tools but these heats were not forgeable. It was evident that if these unusual qualities were to be put to work, the material must be produced by other than ordinary mill methods. We had done considerable grinding and salvaging of Cast High Speed tools for the United States High Speed Steel and Tool Company almost twenty years previously. Hence the casting of high speed steel tools was approached with a backlog of experience. The reasons for the failure of the early attempt to cast high speed directly were clear and could be avoided. Here was a material with tremendous possibilities waiting to be harnessed. It had a high red hardness, extreme resistance to abrasion, the ability to maintain a cutting edge under adverse conditions, had an annealed state in which it could readily be machined, and could be tailor

made to heat treat to Rockwell hardnesses ranging from C 60 to C 72. The challenge was accepted. The result of the subsequent experiments was the commercialization of this new Cast High Speed Steel.

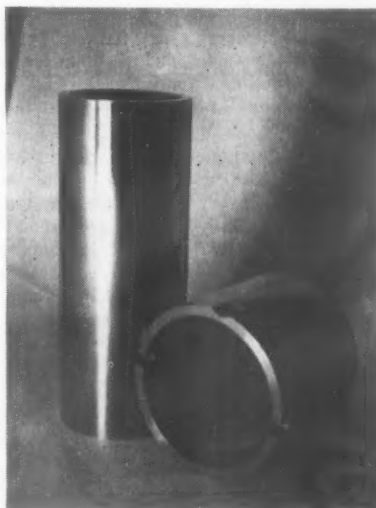
Having developed an analysis that was suitable for direct casting, the first step forward was to design molds and set up casting equipment to turn out sound castings of the correct shape and size. The majority of castings are made by a centrifugal process. Those not suited to this processing are cast in graphite or in permanent cast iron molds. Intricate shapes, such as the teeth in milling cutters, are not cast into the blank for two reasons. First, involved cavities in the molds inhibit the free flow of the charge and form traps for gas pockets. Second, formed molds are expensive to make, hence are not economically justified except in rare cases.

Centrifugal casting is done with a power driven, revolving mold. The mold may be merely a tube or it may be a multi-cavity mold with cavities radiating out from a central pocket into which the charge is poured. Circular blanks for cutters and bushings are cast in the single type mold. When the charge is heavy enough to retain the fluidity of the cast after it reaches the mold, centrifugal force definitely throws the denser parts of the melt to the outside of the mold. This is an important advantage on cutter blanks where the work will be done by that ring of the completed cutter just within the outside diameter. Multi cavity molds are generally used for flat sections and small solid rounds. Since the centrifugal force hurling the charge into the mold cavities is a function of the speed of rotation of the mold, the optimum r.p.m. of the mold must be determined by experiment and then consistently maintained whenever that mold is used if perfect castings are to be produced. The amount of metal charged into the mold and the pouring temperature are important. Likewise, the temperature of the mold affects the rate of solidification of the charge and must be closely governed.

Castings are Annealed

Gravity casting is used principally in the casting of flat plates that are later cut up into pieces as required. In this type of mold, questions of design are not so important as in centrifugal molds. Molds are machined from cast iron blanks or from graphite stock.

Following the casting operation, all blanks are annealed in a heat treating cycle that leaves the castings as machinable as annealed forged high speed steel. The fact that the analysis used has an annealed state is a very important factor in the success of the process. Blanks need not be cast to shape but can easily be worked as desired, leaving only grinding stock to be removed after hardening. This



Finished Bushings.
"... of the applications."

avoids the expense of form molds but, more important, it provides a uniform basis of metallurgical characteristics in all the castings. Subsequent hardening can then proceed on a fixed schedule with the assurance that the results will be as desired within narrow limits.

Annealed blanks are processed thru the various machining operations usually found in tool manufacturing. Turning, boring, milling, keyseating and form relieving operations are all readily performed. Since this material does not decarburize during heat treatment, a minimum of grinding stock is sufficient to clean up cutting edges and hard surfaces following heat treatment.

Heat treating is carried out with precise control of temperatures and timing. Standard equipment is used but the heat treatment varies quite radically from that given the forged high speed steels. For general purpose work, tools are treated to a Rockwell C hardness of about 66. For special purpose applications, the heat treatment can be so specified that Rockwell C. hardness ranging from 60 to 72 can be repeatedly produced.

Ease of Grinding

The ease with which modern Cast High Speed Steel can be ground makes the use of special grinding or lapping equipment unnecessary. In spite of the high hardness possible, the inherent strength of this material permits either the machine or hand grinding of an excellent cutting edge without subsequent honing or lapping. Any grinding operation can be performed that is possible with forged high speed with no more care than is ordinarily used in tool grinding. Overheating to the point of drawing the temper must be avoided. The use of a coolant is not advisable unless a sufficient quantity of coolant is run over the work to keep the entire tool cool at all times.

The design of tools to be made of Cast High Speed Steel need not differ greatly from the conventional designs. The strength of the cast steel is only slightly less than that of the forged but cast tools are generally subjected to higher speeds and feeds than those used on forged tools. Hence, it is good practice to support cutting edges as well as the design permits and to avoid sharp corners, thin webs or any mechanically weak structure. The casting process is adaptable to almost any tool that can be furnished of forged high speed steel. The only exceptions are extremely small or thin tools that are difficult to cast economically and some types of tools with radial cutting faces so long that it is difficult to maintain sufficient alloy density along the entire cutting face. Many of these unusual jobs can be cast if the quantity of tools desired will absorb the cost of special molds.

The wear resistance of Cast High Speed Steel is very high, making it a useful material for almost any application

Reservations for Exhibition Are Breaking All Records

Space is already three-fourths sold out.

DETROIT—In line with the announced thesis of "Tooling for Defense", the 1941 Machine and Tool Progress Exhibition will be confined to the latest developments in the way of equipment, processes, tools, and materials available for speeding up defense production.

Reservations for space continue to pour in at a record rate and more than three fourths of the space for the Show next March has already been taken. Exhibits of a non-educational nature will be excluded from the show, according to Frank Shuler, Chairman of the Exhibit Committee.

"We are endeavoring to make this show 100 per cent useful from a National Defense tooling standpoint," Mr. Shuler said in a recent statement to the press. "Allocation of space and permission to exhibit will be granted only to those organizations whose exhibited products will

requiring high resistance to wear and abrasion. Centrifugal casting of liners is a very economical method of making this type of tool since a tube can be cast with a minimum of stock waste as compared to the use of a solid bar. Wear strips can be brazed in place and hardened in the same operation, requiring only a subsequent drawing treatment to bring out maximum physical properties. Cast High Speed Steel is available in welding rods for use in building up hard surfaces as desired. It handles very nicely under a torch. Since it is air-hardening, the welds have high hardness as welded or may be annealed and rehardened to obtain closer control of the final hardness.

As mentioned at the beginning of this discussion, Cast High Speed Steel is not a new material historically. In a practical sense, the modern cast product is altogether different than its predecessors in that the results of its use are predictable. In spite of the great amount of experimental work done on Cast High Speed Steel during the last five years, it has not been possible to envision all of the applications where the use of it will be of material advantage. Only widespread use in production can build up such information. All of the experimental work and the limited production applications indicate that the rebirth of Cast High Speed Steel will make available a tool material to fill the long recognized gap between the forged high speed steels and the carbides.

be of definite value in simplifying the task ahead for the Tool Engineers of the nation. That task is an enormous one. Thousands of blueprints of designs of 'defense' products will have to be converted during the next year into sequences of manufacturing operations to produce them. With the tremendous shortage of Tool Engineers existing today, every bit of help these men can get in the way of simplifying their job will mean that much time saved in translating defense contracts into mass production."

The 1941 Machine and Tool Progress Exhibition will be held in Convention Hall, Detroit, March 25th through 29th, and is sponsored by the American Society of Tool Engineers. For the annual meeting of the A. S. T. E., which will be held concurrently with the Show, a series of symposia along the same theme of "Tooling for Defense" are planned. Special sections on Aircraft, the Navy, Education, and other features of the National Defense program will be held.

Wherever possible exhibits will be operating in nature—to demonstrate to Production Engineers how the equipment or process functions, as a guide to its applicability to their own tooling problems.

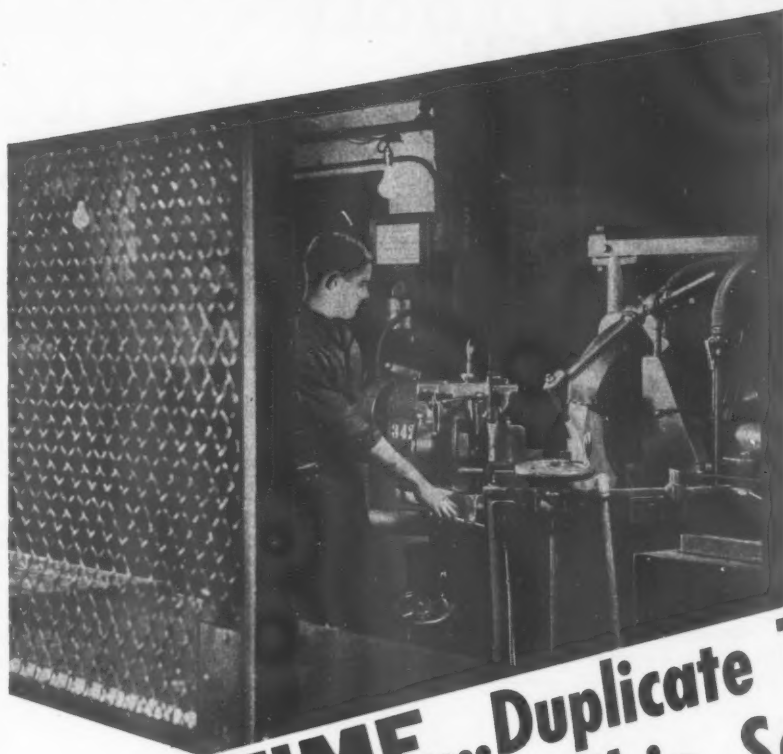
Taken together the exhibits and the symposia should be of great assistance, almost of indispensable assistance, to every Tool Engineer whose work is connected, directly or indirectly, with the Defense Program.

Two Special Issues

In connection with this Show are two special issues of THE TOOL ENGINEER which have been announced for publication in the spring. The Show Number, appearing in March, will contain many highlights of the Exhibition and other special features to aid Showgoers in getting the most out of their visit.

This will be followed in April by an issue of particular significance to all Tool Engineers. Based on the theme "Tooling for Defense" it will utilize the papers presented at the various symposia as a foundation for an issue which will deal exclusively with the various aspects of this vital problem of "Tooling for Defense." There will be special sections devoted to Aircraft, both engines and fuselages, to the Navy, and to other important aspects of the Defense Program.

These two issues of THE TOOL ENGINEER are being designed to benefit the Showgoer in getting the most out of the Exhibition while there and afterwards as long as Tooling for Defense is a major problem in America.



SAVE TIME...Duplicate Tool Shapes AUTOMATICALLY This Sellers Way

Grinding tools to the exact specifications recommended by tool engineers and maintaining these tools to close limits have become of primary importance to high speed production machining operations. And this is an operation that takes time—and the skill of a machine tool specialist.

For this reason many companies have turned to Sellers Tool Grinders—a grinding machine produces tool shapes automatically by following a template cam and reproduces practically any straight or curvex form. There can be no error with a Sellers Tool Grinder and any number of tools can be ground rapidly to the same exacting specifications.

Complete information and prices will be furnished on request.

WILLIAM SELLERS & COMPANY, Incorporated
1626 Hamilton Street

Philadelphia, Pa.



Sellers

Foster Industry

By A. E. RYLANDER

IT has become an accepted belief, in this mechanized age, that industry constitutes a nation's first line of defense. In times of war or preparation for war, a nation turns to it for the manufacture of arms, for the processing of wartime necessities, for the means of transportation of troops and goods. Without industry, no nation would have insurance of its integrity in this age, and even the insurance is comparative; it is a case of the survival of the fittest. Where, until quite recently, it could have been said that "God is on the side of the heaviest artillery", Providence is now definitely aligned with the greater industrial efficiency. It is obvious, then, that however necessary, however vital each component in the structure of a nation, industry is its keystone. Therefore, it is essential that it have the first consideration of government, that it be supported and encouraged.

With agriculture, mining, forestry, transportation and commerce, industry is one of the quintette that, in normal times, insures a nation's peacetime prosperity. People must eat, and raw materials must be manufactured into saleable commodities, transported to market and there disposed of by direct cash sale or other negotiable medium of exchange. And in abnormal times, as depressions, people look to industry to turn the tide toward prosperity. For with rising industrial employment the farmer, the miner and the lumberman can sell the fruits of the soil at prices that will warrant the cropping. There is encouragement to buy and expand; optimism begets confidence. In peace as in war, then, industry is a key factor in a nation's scheme of existence.

Industry, in the United States, has been the basis of a mass prosperity and standards of living equalled by no other nation and approached only by one small nation whose system of democracy is largely similar to our own. From these extremes—the great and the small—which nevertheless have similar ideologies and largely similar industrial set-ups (the manufacture of quality goods at high wages) one can conclude that democracy, as typified by the American Way of free enterprise, has become a pattern for the world. If authoritarian governments have chosen divergent systems, it is not because our system has failed, but because the dissenters have not been able to duplicate the pattern. It may be assumed,

however, that they seek the same goal through a detour. Else, why the employment of American Tool Engineers in projecting what, to a large foreign power, was called the Five Year Plan? Or why, in the planning of a major war by a totalitarian aggressor, should the American system of mass production have been established as a vital factor in the plan? A plan that, so far, has had the merit of success, however deplorable the concept and its execution.

Looking beyond the smoke screen of war we see an objective of economic dominance which is not to be overlooked today.

In a major conflagration, one fights fire with fire, but with controlled fire. With democracy challenged, America girds for defense, that its system of free enterprise be preserved so that the American people may continue to have better homes, a higher standard of living and the enjoyment of what, to less fortunate peoples, may be termed luxuries but which we have come to regard as necessities in our design of living. In our defense scheme, industry is the key citadel; the integrity of America depends upon its solidity. Should industry fail, or its function be overly interfered with, our defense program would be seriously disrupted and, were defense to become a reality instead of a potential threat, our army and navy would be at a disadvantage. Certainly, then, common sense dictates that industry should have, not only the fullest support of government, but of all of the American people. Not alone for the insurance of adequate defense, but for the perpetuation of national prosperity.

As a people, we must look beyond the immediate smoke screen of war and visualize the objective of war, which is largely economic dominance. Have-not nations, jealous of the prosperity of the haves, and lacking or having suppressed the spirit of free enterprise, seek to establish economic parity or superiority by imposing a new economic scheme upon the world. Democracy, they say, is dead. But, in impugning it, they pay us the subtle compliment of copying, not our system of rule by the people, but our system of mass production. Even nations on the defensive, which have looked askance at mass manufacture and inclined

to slower hand fitting and assemblies, now belatedly adopt American industrial methods and Tool Engineering and, in so doing, seem to have turned the tide of battle. There must be something to our way after all.

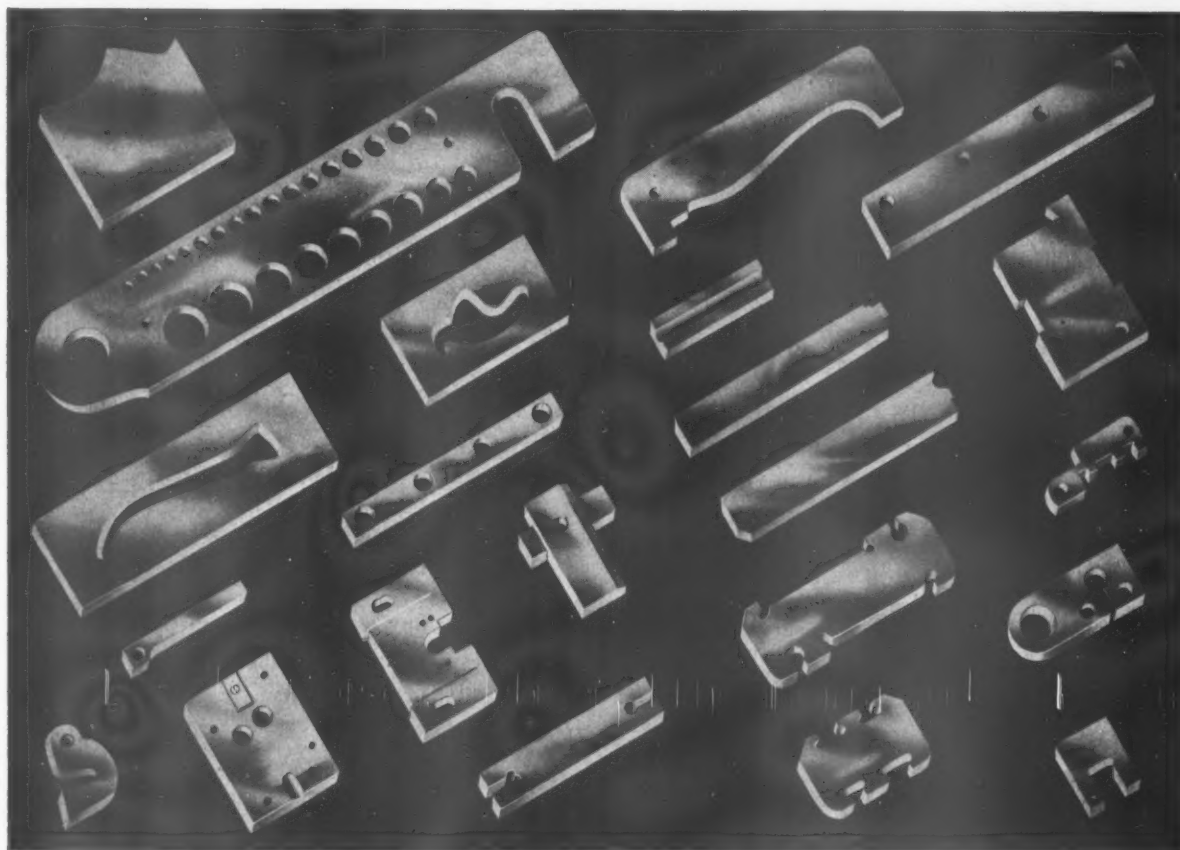
The picture outlined, the whole resolves itself to the simple proposition that, if we are to hold to the American Way, and to improve upon it, (as we have been doing right along) we must give free rein to engineering and invention, and practically free rein to industry. Engineers and inventors seldom abuse their privileges, rather, improve on the design of living, while the major fault of industry has been that, in meeting demand for the production of commodities, it has sometimes overlooked the human equation. However, the balance has lately swung to the other extreme; instead of control, the trend of government has been to hamper industry with unnecessary restrictions and to snarl it up in red tape. This is not a healthy state of affairs in view of the immediate arms program and considering the economic competition which is to come.

Therefore, we stress the need of the fullest support for industry, not only during a period of wartime crisis, but in the coming economic crisis of peace. Then, American industry and Tool Engineering, with the combined genius for manufacturing quality products at prices within the means of the masses, will be the foundation and the keystone in our social and economic structure. For be it known that the normal consumption of American made goods, by the American people, is greater than the manufacture and consumption of goods by all the rest of the world combined. We can be sufficient unto ourselves if needs be, but we don't want that. We want to pass our blessings onto our neighbors, that they may live well, too, and not envy us. It is either our Way, which we know has worked, or the acceptance of ways which have not worked, else the have-nots would not be spilling blood to destroy competition. That our Way may prevail, and provide equal opportunity for all, it is essential that there be the fullest support for American industry. Foster it now, and encourage it in the manufacture of peacetime commodities, that we be prepared to meet the demands of reconstruction. That time will come, and to the economic victor the spoils.

THE TOOL ENGINEER

Don't tie up MEN and MACHINES

GRINDING STOCK FOR PARTS LIKE THESE



It's quicker, easier and much cheaper to use Starrett Ground Flat Stock for special gages, templates, jig, fixture and machine parts, punch dies, etc. Made of high grade annealed tool steel cut lengthwise from the sheet and ground to within .001" in thickness, No. 495 Flat Stock is available in 18-inch lengths in a complete range of widths

and thicknesses. Easily machined and heat treated. Each piece packed in individual envelope and marked for quick identification. Order a supply today. Write for special Ground Flat Stock Folder "T" and a handy reference wall chart.

THE L. S. STARRETT CO.
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STARRETT

GROUND FLAT STOCK

AVAILABLE THROUGH ALL LEADING SUPPLY HOUSES

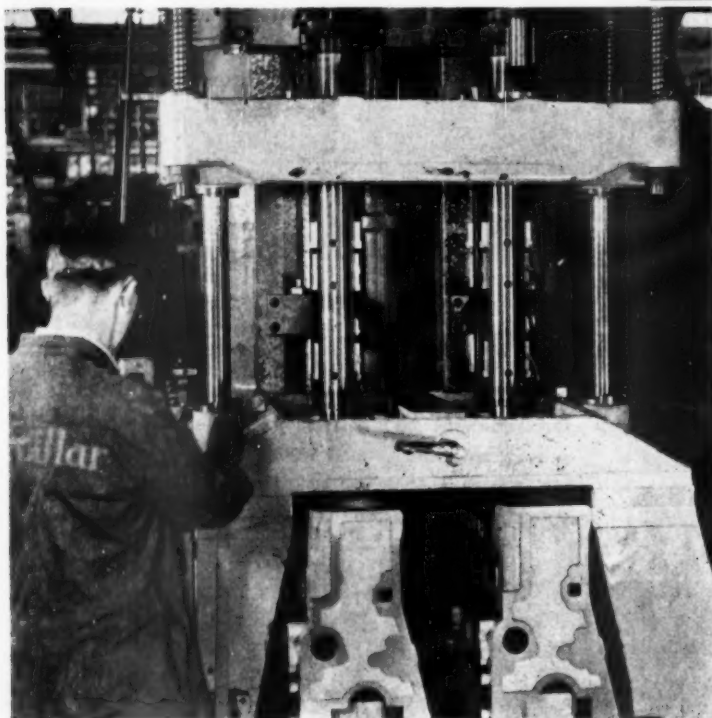
"CATERPILLAR" Diesel Engines

REG. U. S. PAT. OFF.

Rough Bored, Finish Bored, Counter Bored
and Inside Chamfered - All in 1 Operation -



The diversified application of Davis Block Type Boring Tools is admirably illustrated in the interesting set-up shown below. Here, these specially-designed tools are boring "Caterpillar" Diesel Engines complete for cylinder sleeves—rough bore, finish bore, counterbore, and inside chamfer—all in one operation!



Send us prints of YOUR work, for a helpful, specific recommendation.
DAVIS BORING TOOL DIVISION, Larkin Packer Co., St. Louis, U.S.A.



One of five "Caterpillar" Diesel Tractors rebuilding and realigning Highway 101, forty miles north of Santa Barbara, California.



Outstanding among the block type cutters in this tooling is a unit for inside chamfering. This cutter is automatically expanded and contracted by means of an inner plunger bar, and is of the disappearing type. Multiple cutter blocks are also featured, to rough and finish bore. Tungsten Carbide tipped cutters are used.

IT'S NEW

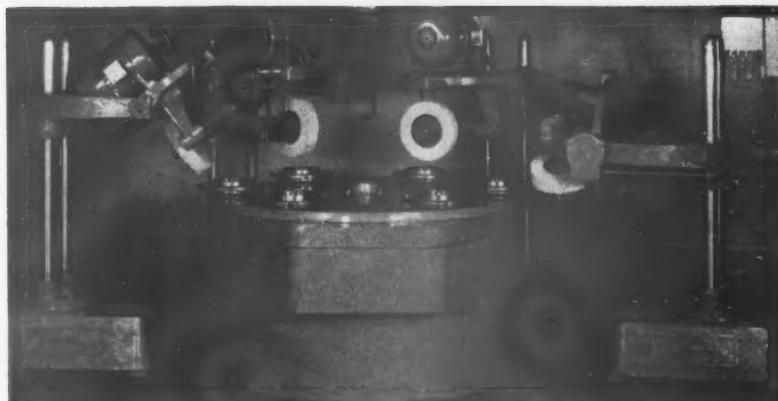
NEW EQUIPMENT—NEW MATERIALS—NEW PROCESSES

Republic Tube Shaping Machine (77)

With the demand for aircraft parts skyrocketing in step with the national defense program, the Steel & Tube Division of Republic Steel Corporation is now producing landing gear struts, aileron torque tubes and other parts on a new machine which automatically shapes tubular products to practically any contour that could be machined from solid stock on a lathe.

The machine, developed by Clarence L. Dewey and his son, Sydney L. Dewey, who have given full time to its development for the past six years, provides accurate control of wall thickness so that it is possible to turn out aircraft parts of maximum strength at minimum weight.

The process has wide application in the shaping of light and heavy gauge tube of different metals at high speed. Welded or seamless tubing of any given diameter and thickness can be shaped for any required use, with the wall thickness under accurate control. This is made

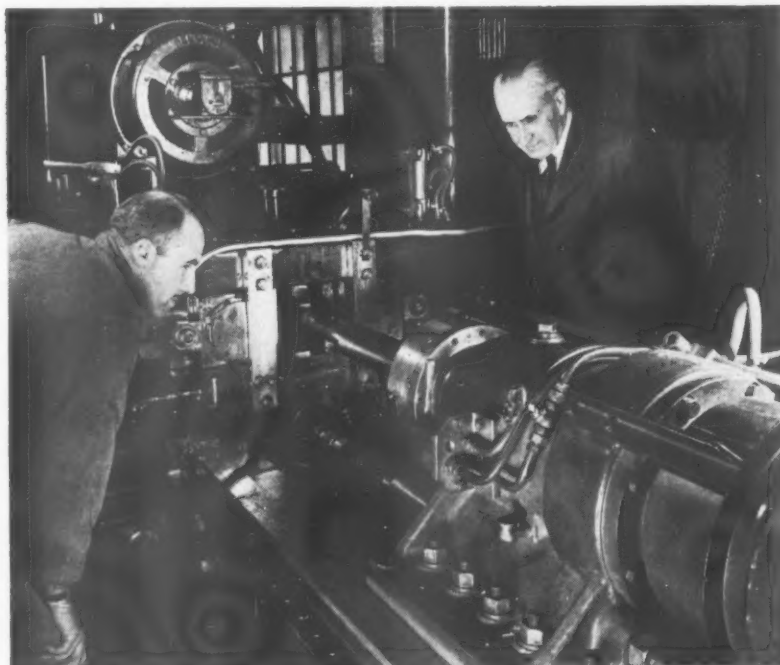


Murray-Way Buffing and Polishing Machine.
The wheels can be adjusted to any position.

thicker, thinner, or held to the original thickness in the reduced section by working the tube with selected rolls under variable tension load.

Shaping is accomplished by the rolls in a moving carriage which travels horizon-

tally along the tube, one end of which is anchored to a rotating chuck, while the other is driven by a power unit which is moved to accommodate elongations and to control the thickness. The shape is controlled by a cam parallel to the tube which moves the forming rolls to, or away from, the tube itself.



Republic Tube Shaping Machine.
After six years' work, wall thickness is controlled.

Murray-Way Buffing and Polishing Machine (78)

A new line of automatic buffing and polishing equipment is announced by the Murray-Way Corporation, Detroit, Michigan. The buffing heads are quickly adjusted to any wheel position. The entire drive is mounted on a turntable which has a full swing. The turntable and ring assembly, as a unit, is swiveled in the yoke member having, in the opposite plane, a full 360° adjustment. Therefore, the wheel may be moved to any position, there being absolutely no blind spots.

The buffing spindle is full floating with adequate means provided for taking up wheel wear and maintaining a predetermined work pressure. The dial table has a constant index time but the time of dwell is varied over a wide range by means of electric controls. The timing device is graduated in seconds and minutes. All indexing mechanism and fixture drives are completely enclosed and operated in a bath of oil.

(Continued on following page)

IT'S NEW

Hannifin Hydraulic Straightening Press (79)

An unusually large hydraulic straightening press with sensitive pressure control and 150-ton capacity has been built by the Hannifin Manufacturing Company, Chicago, Illinois. The base of the press is designed for installation below floor level, to bring the table to a convenient height for easy handling of bulky pieces.

A sensitive pressure control is used, allowing simple and accurate handling. The operation of this type of control allows unusually rapid handling of oper-

ations. Initial movement of the control lever causes the ram to move down rapidly at nominal pressure. The ram will move down until it touches the work, and then stop. Movement of the control lever beyond the approach position causes pressure to be exerted by the ram, with working pressure proportional to the distance the control lever is moved. Any required ram pressure up to the capacity is obtained by moving the control lever down. Releasing the control lever at any point automatically returns the ram to top position with a high speed return stroke.

Barber-Colman New Type T Hobbing Machine (80)

Barber-Colman Company, 213 Loomis St., Rockford, Illinois, announces several new attachments and improvements in



Hannifin Straightening Press.
Sensitive control speeds operations.

When Tooling up for Munition Parts save **TIME-MONEY** and **WORRY** by using these Proved Cutting Fluids **FROM THE START!**

STRAIGHT
CUTTING OIL
Stuart's
Thred Kut

Widely used by Government manufacturing armories and arsenals and the aircraft and related industries. Highly recommended for tapping, threading, deep drilling, broaching, gear cutting, and for all machining of alloy steels.

WATER
SOLUBLE
CUTTING OIL
Stuart's
SOLVOL

This new type of liquid cutting compound was developed because of the need for a "water coolant" capable of handling certain tapping, threading and very high speed turning operations on carbon steels that heretofore demanded straight cutting oil. Stuart's SOLVOL has a higher cutting quality and rust preventative value than ordinary soluble cutting oil. Try it on a few "borderline" jobs and see the difference.

WATER
SOLUBLE
GRINDING
COMPOUND
Stuart's
CODOL

This liquid grinding compound is known and widely used throughout the United States, Canada and Europe. It is highly regarded as an advanced development in grinding lubrication.

THREAD
GRINDING OIL
Stuart's
TK-99 or
SK-81XR

Use Stuart's TK-99 on alloy steels, and Stuart's SK-81XR on high carbon steels. Get production speed up where it counts!

TAKE advantage of the lessons that others have learned in solving the tough problems of achieving maximum production on munition parts work. **STUART OILS** together with **STUART OIL Engineering Service** will help set you up for top efficiency—right from the start!

Write . . . wire . . . or phone today for trial drums of these **Stuart Products**. You'll get 100% satisfactory performance or 100% credit. That's our guarantee.

Lubrication of "Ways"
"STURACO" L-30

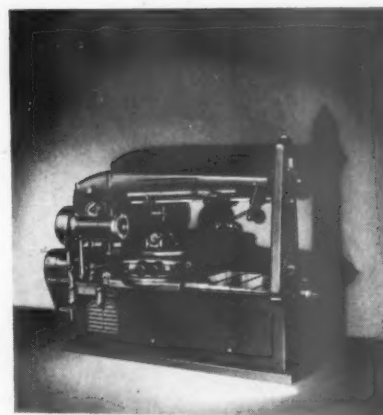
The matter of adequate lubrication of ways, when machine tools are overloaded is important and calls for a special lubricant.



For All Cutting Fluid Problems

D. A. STUART OIL CO., Ltd.
CHICAGO, U.S.A. ESTABLISHED 1945

Warehouses in All Principal Metal Working Centers



Barber-Colman Hobbing Machine
The hob feeds at an oblique angle.

Main point of difference between this machine and the Type A lies in the swivel construction. It provides a means to traverse the hob not only longitudinally but also laterally at the same time. The result is that the hob is fed in an oblique

(Continued on following page)

All in a day's work...



DIFFICULT JOBS—SIMPLE JOBS ... EX-CELL-O ENGINEERS TAKE THEM AS THEY COME !



One of the "tough" jobs recently accomplished by Ex-Cell-O engineers. Part is a heat-treated steel forging—a driven shaft used in new automatic transmission of nationally known automobile. On an Ex-Cell-O Precision Boring Machine (Style 112C) and especially designed fixture, holes for pinion gears are drilled, bored, and finish-reamed from the solid, with tolerances held to .0005", and essential alignment satisfactorily maintained. One Ex-Cell-O machine performs these operations, replacing four machines with four separate operations formerly required to do the job. The one Ex-Cell-O machine maintains the same total production as the four machines did before.

PRODUCTION problems coming to Ex-Cell-O engineers from American industry in the course of a year are many and varied. Some are regarded by others as being so "tough" that they already are labeled as seemingly impossible. In almost every instance, Ex-Cell-O engineering experience and skill provide a practical solution by designing machines, fixtures, and tools to do a precision job... with a minimum of operations... on a money-saving, time-saving basis.

Other jobs are more simply solved, often by an application of a standard Ex-Cell-O precision machine and set-up that will at low cost give extreme accuracy and profitable production.

Whatever your metal-working problem in 1941 may be, if it is one requiring precision work, a good production rate, and profitable operation, it is to your advantage to consult Ex-Cell-O.

EX-CELL-O CORPORATION • DETROIT, MICHIGAN

EX-CELL-O MACHINES
Precision AND TOOLS

EX-CELL-O CORPORATION
1204 Oakman Blvd., Detroit, Michigan

Please send bulletins on Ex-Cell-O
Precision Boring Machines.

Name _____ Title _____

Company _____

Address _____

IT'S NEW

angle to the work which is necessary for taper splines at shaft's end.

Fray All Angle Milling Machine (81)

An improved design of their All Angle No. 7 milling machine is offered by the Fray Machine Tool Co., 515 W. Windsor Road, Glendale, Calif. The spindle of this new unit has a $3\frac{1}{2}$ inch travel and is carried in a head that can be rotated around two horizontal axes lying at 90° with each other and around a vertical axis. It also can be moved through a lateral distance of 12 inches over a slide fitted with a lead screw, or positioned

at any point through a 10 inch movement along its mounting on a circular overarm. Each of the movements and adjustments is equipped with graduated

PLEASE NOTE: The purpose of this department is to call to the attention of its readers new production ideas. To aid readers in getting complete technical data on any item in which they are interested a key number is given for use on the post card bound in this issue.

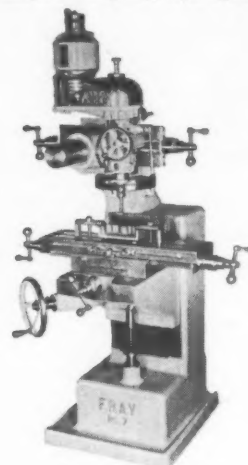
dials for accurate setting up.

Because of this flexible arrangement it is possible to perform all milling, boring, drilling and grinding operations in the

horizontal and vertical planes, as well as angular operations.

Fellows Gear Checking Machine (82)

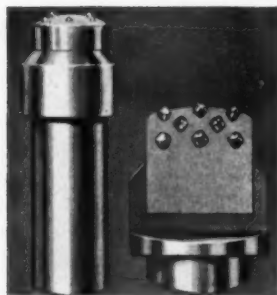
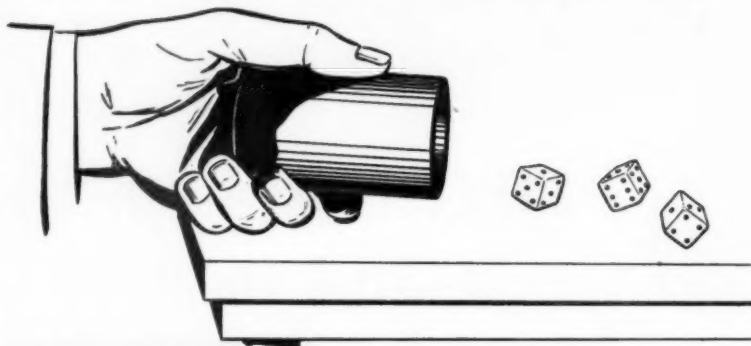
A new machine for checking gears has been placed on the market by the Fellows Gear Shaper Company, Springfield, Ver-



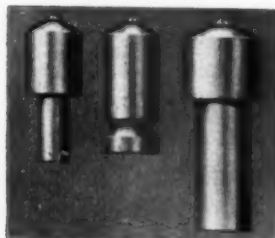
Fray Milling Machine
Also performs angular operations.

mont. It is known as the No. 20M Red Liner and will handle spur or helical gears up to 18 inches pitch diameter. It operates on the same fundamental principle as the regular Red Liner but is arranged to handle gears on centers

Don't gamble—buy industrial diamonds from a reliable source



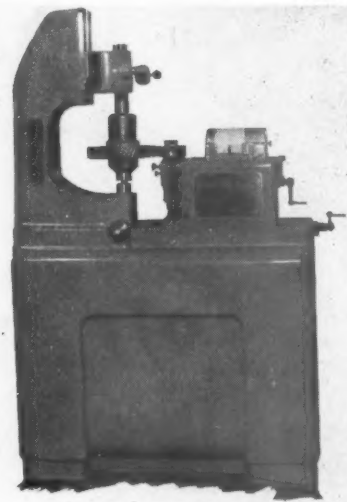
No. NP-1 Fifteen Stone
Diamond Tools



Left to right — Landis Nib,
Norton Nib, Cincinnati Nib

There are vast differences in the qualities of industrial diamonds. There are equally great differences in the knowledge and skill of the various importers and tool makers. A good diamond improperly set is no better than a poor diamond correctly set. It takes long experience to know what diamonds to select for different jobs and how to set them to obtain maximum results.

Anton Smit & Co., Inc., has been specializing in industrial diamonds for more than thirty years. It is one of the few companies that controls all steps in the production of diamond tools—mining, importing, tool making and servicing. To the concern or individual using diamond tools, this unified control is of the greatest importance. In dealing with Anton Smit & Co., Inc., you are assured complete satisfaction in the quality of the diamonds or tools you buy. Large stocks of Bortz, Carbons, Ballas, Splint, Points, Crushing Boart, Powder, etc., in all sizes and qualities on hand. Send for illustrated folder and prices.



Fellows Gear Checker.
Particularly applicable to aircraft.

which are adjustable.

The lower center is adjustable to present the gear in the correct relationship to the master gear, and the upper center for handling gears or arbors of different lengths. This machine can also be arranged for checking internal gears by

(Continued on following page)

ANTON SMIT & CO., INC.
24 STATE ST. (near Battery) NEW YORK, N. Y., U. S. A.



HERE'S HOW TO GET MORE
OUT OF MACHINE TOOLS...

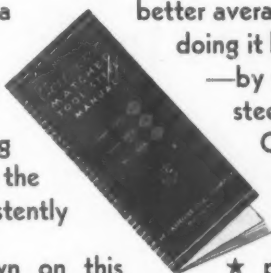
... and save time in the
tool room besides



Suppose each tool you make could be made to produce more pieces
—in fewer days—with less attention in service.

Would that give you the extra plant capacity and the extra man-hours of tool room time you need to meet today's conditions? It might not provide **everything** you desire, but it **would** prevent excessive interruptions to production—and it **would** reduce time spent in the tool room on the repair or replacement of worn or broken tools. Over a period, you could save enough time to account for substantial increases in plant and tool room output.

But how can you assure a
a thousand plants are
treatment of tool steel
determine the right
dures. They are using
Tool Steel Selection to do the
Tool Steels to insure consistently



better average of tool performance? More than
doing it by simplifying the selection and heat
—by systematically pre-analyzing tools to
steels and the right hardening proce-
Carpenter's Matched Set Method of
job—and Carpenter's Matched
good results.

With the literature shown on this
to work in your own tool room—and chances are that some of this literature is already
on file in your tool room. If so, reread it in light of the above.

You will be surprised at the way this system for simplifying
tool room procedure fits into present needs—at the
opportunity it offers for improving tools, relieving
pressure on the tool room, and increasing machine and
press output.



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*Free to tool steel
users in the U. S. A.
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Simplified", price
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IT'S NEW

the use of a suitable holding fixture. It is said to be sufficiently accurate to be particularly applicable to airplane engine gears.

Acme Spot Welders (84)

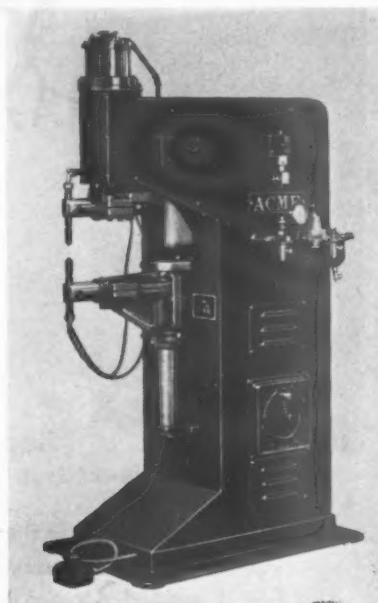
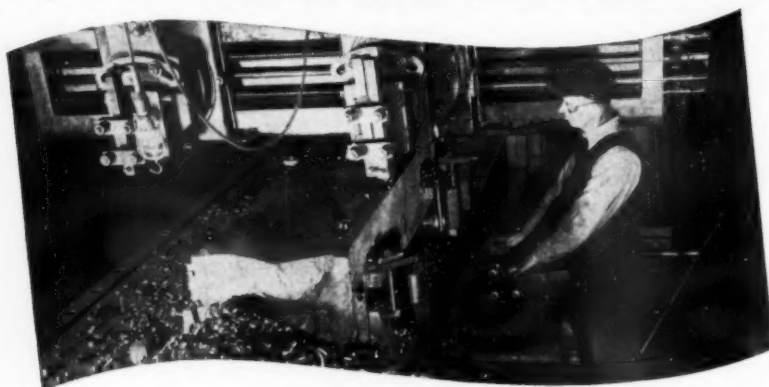
A complete line of direct action air operated Press Type Spot and Projection Welders is announced by the Acme Electric Welder Company, Huntington Park, Calif. This line of air operated spot welders is manufactured in transformer capacities from 30 KVA at 150 KVA. In the smaller capacity welders throat

depths are available from 12" to 30", and in the larger capacity welders from 12" to 48". Eight steps of heat regulation are standard but up to 32 steps can be supplied on special order.

The all-welded fabricated steel construction of the welder bases not only provides extreme rigidity and sturdiness but a modern appearance.

Standard features include watercooling of secondary, column, and electrodes, universal double end reversible horns, positive locking type heat regulating switch, piston packed mirror ground air

cylinder cushioned on both up and down stroke.



Acme Spot Welder.
All-welded steel construction.

"It Just Keeps Rollin' Along!"



PRODUCTION, like Old Man River, has to set a pace and maintain it. It's a double-edged problem for which we've been supplying answers for almost a century. There's an A-L Tool Steel that will give you *performance*—let you set a "max" schedule; perhaps even save you from expanding into more plant. And the same steel brings you complete uni-

formity from lot to lot; which means *schedule maintained*.

We've backed these advantages with dependable supply from stocks coast to coast, and with a Mill Service organization experienced in avoiding "trials and errors" for you. ● Let A-L Fine Steels keep you rollin' along!

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Tool Steel Division, Watervliet, N.Y.
Send me a copy of your new "Handbook of Special Steels"

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T 104

Lyon Assembler's Bench Bin (84)

An assembler's bench bin is the new product of Lyon Metal Products, Inc., Aurora, Illinois. The bin concentrates a large supply of twelve different small parts, such as nuts, bolts, screws, cotter pins, springs, and washers, on a bench space of only 16" by 9". This speeds production by permitting the assembler to work without over-reaching or getting up to locate scattered parts.

The compartments are in three groups of four each, affording larger capacities for the bigger or more frequently used parts.



Lyon Bench Bin
Small parts in easy reach.

THE TOOL ENGINEER

VAN NORMAN MILLING MACHINES...



VAN NORMAN Ram-Type Universal Millers are rigidly built for heavy cuts . . . sensitive and accurate . . . easy to operate and control . . . readily adaptable to a wide range of set-ups. On the new No. 26, shown, the massive table, knee and saddle are rapidly traversed in six directions, controlled at front and rear. Saddle and knee feeds are also front-and-rear controlled. Sliding ram and swiveling cutterhead are larger and heavier . . . combine their adjustments to permit successive horizontal, angular and vertical cuts with a minimum of resetting and with no attachments at all. Net result: Faster, easier, more accurate milling that cuts cost, builds output and profits. Write today for bulletins on Van Norman's complete line of Ram Type Universal Millers.

Van Norman Machine Tool Co., Springfield, Mass.

New Literature

Of Interest to the Tool Engineer

(116) Educational Calendar

Fundamentals of Machine Shop Practice in 12 Easy Lessons. Continental Machines Inc., 1304 S. Washington Ave., Minneapolis, Minn. An educational calendar of unusual interest. While they last copies will be sent gratis to any firm which has a good place to display it. It

presents in easy, understandable form, the opportunities for metal craftsmen.

(117) Lathe Catalog

Speed Lathes, Catalog No. 400. 24 pp. Schauer Machine Company, 2066-68 Reading Road, Cincinnati. Illustrates and describes complete line of high produc-

tion bench and pedestal speed lathes, especially designed for finishing, polishing, burring, or lapping small parts. Includes specifications. Shows variable speed and vacuum type holding fixtures.

(118) Steel Stock List

Alloy and Machinery Steel Data Stock List. 48 pp. Crucible Steel Company of America, New York City. Contains tables of analyses, physical properties and stock information.

(120) Turret Lathe

The No. 2 Turret Lathe. 8 pp. Morey Machinery Company, New York City. Illustrations, description, specifications of this turret lathe.

(121) Hydraulic Cylinders

Push Pull Raise Lower with Hanna Cylinders Catalogue 228. 28 pp. Hanna Hydraulic Cylinders Catalogue 229. 20 pp. Hanna Engineering Works, 1772 Elston Ave., Chicago. Two new attractive catalogues of this company's line.

HOW TO ORDER

Booklets listed in these pages or information on new equipment may be obtained by using the post card bound in this issue. Merely fill out one coupon for each item desired, being sure to print plainly and to include position and company. Mail the card to us and you will receive the information desired at once.

(122) Gage Blocks

Johansson Gage Blocks and Accessories. Catalog 15, 36 pp. Ford Motor Company, Johansson Division, Dearborn, Michigan. Complete catalog of these precision measuring blocks.

(123) Lathe Catalog

Series "S" Lathes, Catalog 16-T. South Bend Lathe Works, 927 E. Madison St., South Bend, Ind. This catalog describes three types: toolroom, quick change gear, and standard change gear.

(124) Band Sawing

The World's Fastest Precision Method of Removing Metal. 66 pp. Continental Machines, Inc. 1304 S. Washington Ave., Minneapolis, Minn. A spiral bound collection of the specifications of the various DoAll models.

(125) File Catalog

Cleveland Files. 28 pp. Cleveland File Company, Cleveland, Ohio. Contains full descriptions of all file types, their uses and applications.

(126) Steel Plate

Speed Case Free Machining Steel Plate. 20 pp. W. J. Holliday & Co., Hammond, Ind. Description of a newly developed low carbon open hearth steel plate. This steel is said to machine without tearing and is usually machined without resorting to the use of cutting oils.

Double Duty-

THREAD OR HOLLOW MILL WITH THE Same Head

TYPE DBS—FOR BROWN & SHARPE AUTOMATICS

Time savings in keeping with high speed quality production are distinctly improved by the DBS—adjustable compensating float which cushions the die on the work, preventing torn or distorted threads, regardless of speed. You can hold this head closed while turret indexes or close it by stop just before the threading cut—thus accommodating all tool set ups.

CIRCULAR CHASERS SAVE TIME—Initial adjustment to positive cutting size is by two screws which move all the chasers uniformly—individual adjustment is avoided. Loosen only one screw to replace these chasers with a freshly ground set—and with the certainty that diameter will not change in production.

WHAT ABOUT DOUBLE-DUTY?—You can switch from chasers to hollow milling cutters with blocks intact. Circular chasers give 10 times the life of ordinary kind—you can grind and regrind to 270° of chaser circumference. Think of the time and tool investment this improved "Double-Duty" DBS head will save on your B&S jobs.



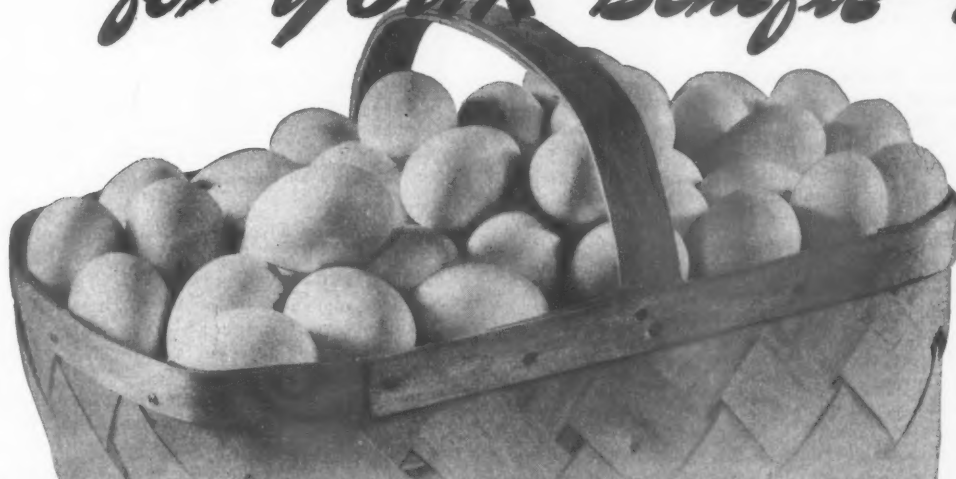
Pages 14-17 in this new 68-page threading book gives the complete story. Ask for D-38.

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*Here's ONE source of supply for ALL your
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"PUT all your eggs in one basket," the canny Carnegie once said, "... and then watch the basket!" We invite you to try it.

Put all your shop tooling problems up to Firth-Sterling—and watch the results!

The completeness of our companion lines enable us to render a full and impartial service. When your tooling problems require *both* Steel and Sintered Carbides, we *have* both! Thus, your *needs*, alone, determine our recommendations.

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FIRTHITE SINTERED CARBIDE—Super cutting tools.
CIRCLE C—a Super High Speed Steel for severe work.
BLUE CHIP HIGH SPEED STEEL—for general shop use.
SPECIAL GRADES OF HIGH SPEED STEEL—for particular requirements.

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Production Perspectives

News of Mass Manufacturing Everywhere

THE Federal Reserve Board placed its adjusted index at a new all-time peak of 131 per cent of the 1935-39 average. This was a jump from 128 in October and 124 a year ago. "Recent increases in activity have been widespread," Federal Board's bulletin stated. "Expanded output has occurred not only in industries directly engaged in production of war materials and in those making goods formerly supplied by European producers; war and defense developments have also increased civilian expenditures. In the aggregate these increases have much more than offset losses resulting from the closing of many foreign markets for American goods."

National defense contracts awarded before the start of November will provide an additional 4,000,000 jobs in the United States by next June, swelling total employment to a level far above the 1929 peak, according to a preliminary study by the Division of Industrial Economics of the Conference Board, New York City. Increasing by 103,000 persons in October, employment throughout the country stood at 48,638,000 persons, a figure bettered only in a few months of 1929, the Conference Board said.

The Massachusetts division of unemployment compensation reports that the national defense program has altered the unemployment picture in Western Massachusetts to such an extent that age limits have been waived by many employers. The case of a 73-year-old tool maker who was hired in Springfield was cited along with that of a Greenfield manufacturer who formerly demanded all-round machinists and is now content with workers with any skill whatever. It was asserted that the aircraft industries in Connecticut have attracted a number of Western Massachusetts workers while the U. S. Armory in Springfield has brought from Connecticut men experienced in firearms manufacture.

THE problem of speeding up rearmament was described

Dec. 16 as one of "terrible urgency" by William S. Knudsen, former president of General Motors Corp. and now production chief for the Defense Commission, in letters to machine tool manufacturers and their employees. Declaring nothing was more vital to the country's welfare just now than to hasten production of machine tools "desperately needed" to make airplanes, torpedo boats, destroyers and other weapons, Knudsen wrote the manufacturers: "I'm not telling you how to do your job. But if you could see as I do, from the inside, the terrible urgency of the situation, you would agree with me that I am not asking too much in requesting that you use every conceivable effort to speed up delivery and increase the production of machine tools during 1941. Let's forget everything except the welfare of our country. The industry as a whole has done practically the impossible in trebling its rate of output in the last two years. I am appealing to you to do the impossible again."

A few days later the President drastically re-organized the defense set-up. He created a new board into whose hands he placed complete authority. Under the new arrangement Mr. Knudsen becomes absolute head of all defense production.

Colonel Russell L. Maxwell, administrator of export control, announced at Washington Dec. 4 that 41 types of machine tools hitherto exempted will be subjected to export

license control after Dec. 10. The "increased pace" of the defense program makes this necessary, he said. Col. Maxwell emphasized that placing an article under the export control plan simply subjected it to a licensing procedure and "in no sense implies an embargo."

AWARD of contracts to the United Aircraft Corporation for acquisition construction and installation of additional facilities at the Company's three plants, all in Connecticut, has been announced by the Navy. The awards total \$18,160,746. The largest award of \$14,799,000 went to Pratt & Whitney division for addition facilities at East Hartford. This expansion will cover approximately 434,000 square feet of floor space. A \$1,761,746 contract went to Hamilton Standard Propeller Division for facilities at East Hartford and for additional machinery at the division's rented plant at Pawtucket. A \$1,600,000 award went to Vought-Sikorsky Aircraft Division for additional facilities at Stratford, amounting to about 258,200 square feet of floor space.

BOTTLENECK-CONSCIOUS AMERICA



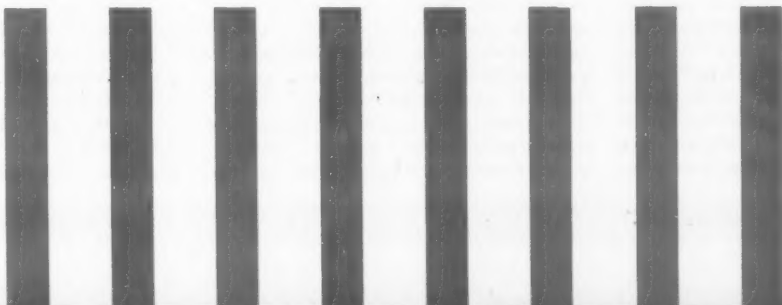
Charles Addams in *The New Yorker*
"Can you step up here just a moment, Mr. Hodgins? I think I've found your bottleneck."



Engine Production for Defense

THE Internal Combustion Engine is one of the greatest of all achievements of the engineer. Through it man has gained a freedom, a power hitherto undreamed of; it has put into his hands a new experience; when he presses down the accelerator or pulls back the stick he feels the master of his element—a god within his machine. In America this new creation of man has reached its highest development in aiding the peaceful pursuits of its creator. In thirty million automobiles, in countless aerial transports and private planes, in ships and motor boats it has served him—making his performance of business more expedient, enriching and extending his leisure pursuits.

But this thing of power man has made has not always been turned to constructive ends. The internal combustion engine brought with it the tank, the bomber, the submarine, and the torpedo boat. Today an awakened America finds a bristling world about her, and in desperation turns to the Tool Engineer. "Build us more engines," America cries; "Build us more of the engines of war!" So today the Tool Engineers concentrate upon the problem of mass production of engines. It is a problem that has been solved once: thirty million cars attest to that. But this is a new kind of engine he must produce. Sustained velocities and reduced weights create stresses unencountered in the land engine—for the engines of air and water have never before been *truly* reduced to mass production methods; the high precision and the low production have been better achieved by the skilled craftsman. Today the picture is changed, the curse is lifted from the machine, we know now that production progress is not gained by having more people do the same thing in the old way but by introducing new methods and new machines so that fewer workers with less skill provide more engines with greater precision built into them. It is not a task to be undertaken lightly—this production of the engines of war—but it is a task which is taken up in the hope that these new methods and new machines will survive the onslaught of war and in a new dawn of peace be turned again to the progressive pursuits of a prospering nation.



Aviation Engines

They Represent Precision Manufacture



In the mass production of aviation engines for Defense, Tool Engineers face new problems of precision manufacture; here are some of them.

THE manufacture of aviation engines is one of the most important phases of our National Defense Program and many of the problems with which we are confronted in this industry must be solved by the Tool Engineer. The events of Europe during the past year have aroused in the general public an interest in our defense preparations that has not been evident since World War One over twenty years ago. Much of this public interest is regarding the status of our air force, not only because aircraft are relatively new and probably appeal more to our imagination, but because much of the success of the German Army has been due to their air force, and the ability of England to resist invasion has been largely due to the efforts of their Royal Air Force.

Because we paid little or no heed to the war preparations of Germany, our American industry is now confronted with the task of meeting this war time volume production in approximately two

by
KENNETH E. SUTTON
General Superintendent
Wright Aeronautical Corporation

years instead of the seven years used by Germany. During this seven year preparation program it has been estimated that Germany spent approximately one hundred billion dollars on preparation for war compared to some four and a half billion dollars spent for defense in the U. S. A. during the same period. There has been some criticism of the large sums appropriated by our present Congress for National Defense but our proposed expenditures will probably be less than one seventh of our national income compared to Germany's expenditure of over one half her national income for a seven year preparation period to say nothing of expenditures since the war started.

In Germany, however, during the

period since 1933 the aviation industry has not only been government controlled but also subsidized so that there has been no limit to the amount of money that could be expended to provide increased facilities. There is no question but that this plan has given Germany a great advantage in quantity, but our system of intense competition between private companies has given us a distinct edge on quality and performance. Also, our product here in the U.S.A., especially the engines, has been engineered for transport service building thousands of hours of service instead of hundreds into each engine. While in a military plane the extended service may not be required, the dependability that goes with this endurance is a decided asset.

However, we have now found out that a slight superiority of quality in aircraft is of little avail against great preponderance in numbers and our American aircraft industry is now being asked to produce quantities that would be considered

fantastic were it not for the present emergency. When the original program of 50,000 planes per year was first announced some of the newspapers and politicians expected industry to turn a few handspins and produce this quantity in some manner. This was partly due to the fact that 50,000 per year is small figure when you compare with automobile industry figures. However, when a little real thought was given this program and men like Mr. Knudsen were called in to assist the government it became evident that it would require several years regardless of the amount of money available for the program.

Machine Tool Output Would More Than Double

The 50,000 plane per year program represents an approximate increase in volume of ten times over our production rate of early 1939. The additional machines required for the manufacture of engines alone, would be valued at somewhere near \$300 million whereas the normal output value of the entire machine tool industry previous to this war emergency was only about \$130 million per year. Some 80 to 100 thousand new men would have to be trained in the fabrication of engine parts and over 200,000 new men would be required by the airplane industry. The bulk of these 300,000 new men would come to the industry inexperienced due to the fact that the industry in general has not had sufficient volume during the past ten years to train any great amount of men.

Our company, the Wright Aeronautical Corporation, has been assigned some 20,000 engines or nearly half the engines required for the Defense Plan up to June 30, 1942. We manufacture engines only and our product is roughly divided into three groups of air cooled engines:

WHIRLWINDS—7 and 9 cylinders rated at 320 and 440 H. P. used principally for trainers and tanks.

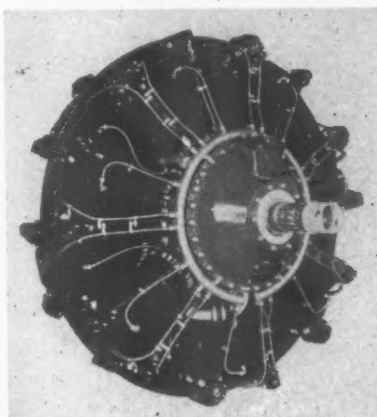
CYCLONES—9 cylinders of 1820 cubic inch displacement rate at 1,000 H.P. two years ago and now rated at 1,200 H.P. These engines are used in pursuits, bombers, and transports, for our Army and Navy and also power most of our nation's commercial transports.

DOUBLE ROW CYCLONES—14 cylinders rated at 1,500 H.P. two years ago but now increased to 1,700 H.P. used principally in bombers and also to power Pan American trans-Atlantic Clippers, and we have now started production on our 18 cylinder double row Cyclone rate at 2,200 horse power.

While these three general classifications cover our entire output there are many variations in each general type. For instance, in our nine cylinder Whirl-

wind which is a type we have had in production for ten years we must make special main crankcase, special crankshaft and other parts when this engine is used in a tank. For each different plane there are minor variations in the engine which complicate the planning and execution of production. Due to these many variations we are forced to stock over 10,000 different parts and normally have in production in our machine shop approximately 3,500 different parts. The 1,200 H.P. single row Cyclone for example, requires about 800 different parts and over 5,500 individual pieces, and of course, the larger double row Cyclones have a correspondingly increased number of parts.

The first and perhaps most important phase of producing engines takes place



Wright Double Row Cyclone.
Today 1,700 H.P., Tomorrow 2,200 H.P.
after that who knows?

in our Engineering Department, where we have several hundred men engaged in the design, calculation of strength, and specification of materials for new engines, and also the improvement of existing models. However, the completion of drawings for a new model does not signify the start of actual production because the next step is the building of one or two engines for experimental testing. While these experimental engines are built in our experimental department, and parts machined with few jigs and fixtures by the highest grade of machinists we can find, we are very careful not to hold special limits of finishes that would not be done when the model reaches actual production in our regular machine shop. These experimental engines are then run under close supervision of our experimental test engineers not for the 150 hour period prescribed by the C.A.A. or the Army and Navy, but for many times that period and often considerable of this running time is at a power higher than that for which the engine is rated. This experimental testing

does not stop when the engine is released for production but continues with the idea not of seeing how good the engine is but to find out weak points and correct them.

When the model is finally released for actual volume production the first step is the procurement of raw material and production tools and machines. The demand for quality in our engine is such that we cannot procure a consistent quality from steel warehouses which means that special heats must be rolled for each different type of steel and each size. This quality of steel is produced by only a few steel mills with the result it requires from three to five months to procure even reasonable quantities of all the different sizes and types of steel required for the production of a new lot of engines. Each lot of steel bar stock or forgings received is checked, not only for chemical analysis, but also is examined microscopically to check for dirt in steel and is also checked for heat treating qualities, and strength. In our Foundry, chemical analysis is made of the various heats poured daily and a test bar is poured from every heat for check of casting metal strength.

Use Operation Sheet

While we are procuring the raw material for a new model, our Production Engineering Department, with personnel of over 400, must carefully lay out the fabrication methods for each part of the engines, and order and procure the necessary machines and tooling. For each individual operation our Tool Engineers prepare for the machinist in the machine shop a complete set of instructions called an operation sheet which lists all the tools and gages required to perform the operation, indicates the machine required, and in many cases shows sketch to indicate machining dimensions. From these operation sheets our tool designers design the necessary tools, jigs and fixtures. For each new model much of the work must be done two and even three times as original release is usually for less than 100 engines at rate of 10 or 20 per month. Perhaps a year or more later when "bugs" are all worked out and definite Sales Requirements established this model must be re-tooled for 100 per month or greater volume.

In the machine shop we require each operator to get the operation sheets before starting work on an operation and have floor inspectors, whose duty it is to check the first piece machines. After the parts are finished they are given a 100% inspection in accordance with operation sheet specifying all dimensions to be checked. The thoroughness of our inspection department can best be shown

by the fact we have one inspector to every eleven or twelve men on production work.

When the parts reach the assembly floor we have definite inspection operations set up after a certain portion of each assembly is completed. To eliminate putting undue stress on many bolts we tighten many nuts with a torque wrench which only allows a certain amount of tension to be exerted on the parts. After an engine is assembled it is set up on a test stand for what is known as the production or green test. The engine is run under its own power from a relatively low speed to full speed and power in about six hours time. After the production test the engine is completely disassembled

After completing all these checks the engine is run one half hour on straight gasoline to remove any lead deposit from the high test gasoline. The engine is then removed from test stand and sent to the Packing Room where there are some 60 checking operations performed before the engine is slushed internally and externally to prevent corrosion during shipment or storage.

A year ago we were producing ten to twelve engines per day. We are now producing in our Paterson plant approximately three times that amount and expect to reach our maximum of fifty engines per day by early spring of 1941. This increased output has required the

additions to our foundry and to our assembly and test. Before these additions were complete we found that we would not have sufficient space so we have taken over two large silk mills totaling nearly 900,000 sq. ft., made necessary changes and had machinery installed in less than two months time in each case. These additions have given us a total of over 2,500,000 sq. ft. or over three times our 1939 area.

Changes Made Constantly

These expansion figures I have just given may look small when compared to automobile figures but they really represent a great problem when you consider the character of the product, which is just coming out of the experimental stage. It is not possible for us to put out a model and make it without changes for approximately a year, then shut down, re-tool and start manufacturing again. Instead, our changes are being made constantly as weak points are brought to light in our product for many of these weak points are peculiar to certain plane installations only and can only be found in actual service and not on the test stand.

The expansion in our plant was not made on proven models as usually by the time a model is really tooled for production we have a new engine that is at least a year in advance as far as engineering is concerned. In the year previous to the present emergency the bulk of our production had been of the G-100 model Cyclone at 1,100 H.P. However, our 1940 production has been mostly of the G-200 Cyclone at 1,200 H.P. and our Double Row Cyclone at 1,600 H.P. Both of which are new engines with nearly all major parts completely different than 1939 production and neither of these engines was produced in 1939 at rate of over 25 per month.

Also, our expansion to date was not the result of one increase but of three distinct and separate step ups. The first schedule on which we planned and ordered tooling and machines and also started to erect new buildings called for 150 of the G-200 and 300 of the GR-2600A models per month in addition to models already in production. However, before the new buildings and equipment were completely finished or delivered we were required to increase these new requirements about 80% which called for complete re-study and in many cases re-tooling to take advantage of most economical equipment for the increased quantities. Since September, 1939 we have now had our third schedule increase for our Paterson plant necessitating additional studies of tooling and consequent re-design to say nothing of duplication of tools. In addition to the above steps which were



General View of Wright Factory.
Cylinder barrels in process are visible down the full length of this aisle.

and parts laid out on tables where each part is carefully inspected not only for wear or scores, but also for possible cracks that may have developed due to testing and many of the parts are checked here with high power magnifying glasses. If any part is found defective it must be replaced with a new part and another production or penalty test is run and the engine again is inspected.

Goal of Fifty Engines per Day

If all the parts of the engine pass the inspection satisfactorily, the engine is re-assembled and again put on a test stand for final test which only requires three to four hours. During this final test, the engine is not only checked for horse power but also for fuel and oil consumption, temperature, and at many other points which must meet specifications set up.

increase in our personnel from 5,000 a year ago to 14,000 at the present time and we expect to reach 17,000 men before attaining full production. Very few of these 9,000 men we have added were skilled machinists and consequently we have had to use many of our older men as instructors as we do nearly all our training right on the job. The Paterson Vocational School has cooperated with us 100% and established night and day classes through which boys were given a preliminary training in as little as four weeks time. This cooperation has allowed us to obtain nearly all our increased personnel from Paterson and immediate vicinity rather than import large numbers of men from out of town.

A year ago we had approximately 800,000 sq. ft. of floor space. To this we have added our new machine shop building which is two blocks long and built

BARNES
BETTER Hack Saw
BLADES

**in
the
Motor
Industry**



The American motor car industry has an invested capital of one and one-third billion dollars, provides employment (directly or indirectly) for more than 6,000,000 men, and is the country's largest consumer of steel, rubber, plate glass, upholstery, mohair, nickel, lead, gasoline and lubricating oil. Its plants run at high speed, lead the world in production efficiency. Its metal cutting requirements call for an increasing degree of accuracy and a constant lowering of costs. Wherever these twin results are most satisfactorily achieved, you'll find Barnes Hack Saw Blades and Band Saws on the job.

BARNES

To serve the motor industry—and a score of other important industries—Barnes Hack Saw Blades and Band Saws are carefully made in a plant devoted exclusively to metal-cutting blade manufacture. Tooth cutting, setting, heat-treating, drawing and quenching employ the most modern machinery, electrically controlled furnaces, expert supervision backed

by years of experience in quality blade production.

These are days when distributors are earnestly striving to satisfy their customers' demands—*your* demands. Avoid a bottle neck. Look over your stock *now*—order as far in advance as possible.

Specify Barnes Blades.

Write for a free copy of the Barnes
Manual of Metal Cutting Information
—full of facts you should keep handy.

W. O. BARNES CO. INC.
DETROIT, MICHIGAN

definitely carried through for our expansion there were a number of intermediate studies made by our Production Engineering Department on various schedules before they were definitely released by management.

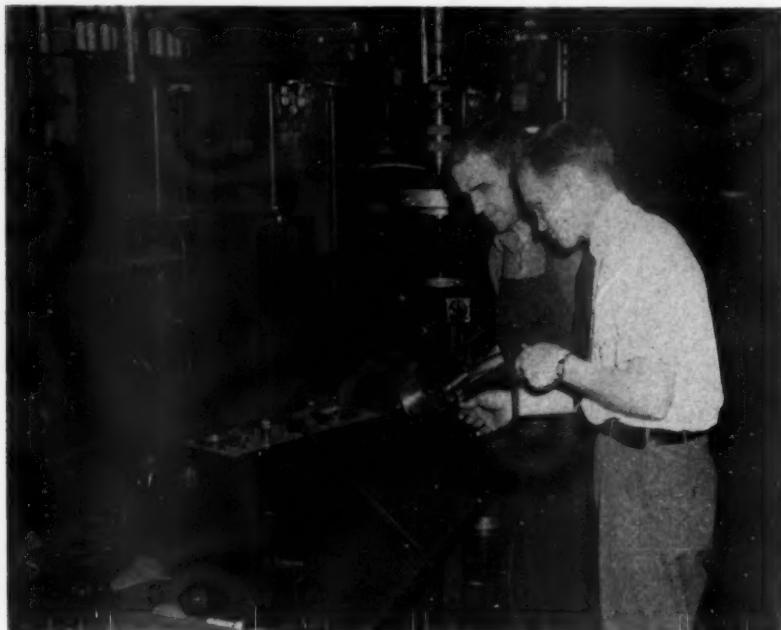
Handling such an expansion by steps does not allow the most efficient and economical tooling for several reasons. Changes are frequently made in parts which do not allow part to be fabricated most economically on equipment on hand or on order, but due to the rush of incorporation of changes or high cost of equipment we often must make the best of equipment available. Also, the increase in scheduled amounts might often justify

gines per month. Since starting our production engineering for this Cincinnati plant some 4 months ago there have been changes in many of the major parts which have upset the work done to date. For instance, just a few weeks ago it was found necessary to have 8 oil holes drilled in the Prop Shaft where we already had machine under construction to drill at one time the six previously specified holes. Also, a new clutch has just been released for this model which will require some 40 new parts never released for production and most of which are of the high precision type and require extensive tooling. These conditions are not unusual to us nor to the industry and I mention

to the value from \$100 to \$120.

In our aviation engines we not only have to maintain accuracy for the purpose of controlling running fits but to insure that there is no surplus metal left on parts that is not absolutely necessary for the strength of the part. An example of this practice is in the steel crankcase where we just finished ordering \$170,000 worth of machines and adding 400 minutes to machining time by incorporating scalloping operations to remove a few pounds of steel not required to strengthen the crankcase. With the exception of a few small external flanges and levers there are only two important forgings used on our engines that are not completely machined all over. However, these two major parts, the pistons and rocker arms are coin pressed to insure accuracy of forgings. This weight reduction study applies to every part and minimum sections are used throughout the engine with the result that we must remove a large amount of stock from most of our forgings. Removal of large or uneven amounts of stock necessitates a double machining of many of our parts, a roughing operation removing the bulk of the excess stock after which we often do our heat treating to remove all strains and then all dimensions must be finished machined and ground.

In our machining processes steps must be taken to eliminate tool marks, sharp corners, sharp edges, and scratches. Due to the low weight to H.P. ratio of our engine nearly every part is stressed very close to the limit and any sharp edge at corners in counterbore, toolmarks on external surfaces or in drilled holes, may fatigue easily under constant use near the limit of strength and may cause cracks resulting in part and engine failure. When a part fails in one of our engines in service it isn't always convenient to get out and let a tow car bring the plane in. Removing sharp edges, elimination of sharp corners and tool marks is a religion in our shop and must be in any plant producing aircraft engines. Drilled holes in highly stressed parts are seldom present in our engine parts. All such holes are reamed and many are ground even though the hole is only a lightening hole. The edges of oil holes must be radiused both on outside and inside and many times the only way we can do this is by using dental tools. Nearly all our counterbores must have a radius and in many cases this work can only be accomplished by hand polishing operations. Removing a sharp edge is not done by passing a file over it making two sharp edges. We grind nearly every external surface and many internal surfaces because we find this cheaper than the polishing necessary after even a careful turning operation.



Profilometer in Use.
To determine the quality of finish in a honed cylinder barrel.

better tooling but time will not permit re-ordering, etc.

New Plant Devoted to One Basic Engine

Our new plant now being constructed at Cincinnati will about equal the output of our Paterson plant which I have been discussing up to now and here we will have approximately 12,000 employees, 2,000,000 sq. ft. of space and machine tools costing over \$20,000,000. This undertaking affords us a better opportunity to do a good job of tooling and equipping our new plant as we have a definite schedule of one basic type of engine to manufacture. However, we again are faced with the job of putting into heavy production a new model, the CR-2600B rated at 1,700 H.P., as our production to date has been fabricated with experimental tooling methods at rate of less than ten en-

them only to show some of the difficulties in tooling up for production on such an experimental product especially when so little time is allowed in which to get into full production.

In addition to the difficulties due to the experimental nature of our industry there is a basic difference in the fabrication of all our parts as compared to automotive parts which is due principally to weight of engine per horse power produced. Our aviation engines have decreased from 2 pounds per H.P. not so many years ago to an average of less than 1.1 pounds per H.P. at the present time and we expect to get down to 1 H.P. per pound in the near future. This limitation of weight is very important as the payload of an airplane for commercial purposes is increased by each pound saved in construction of engines and plane and it has been estimated that each pound saved adds



WRIGHT
DUPLEX—
CYCLONE ENGINE

2000 H.P.
18 CYLINDERS

5D—Two Spindle Potter & Johnston Automatic equipped with specially designed tooling for boring, turning and facing Aircraft Engine cylinder barrels. The set-up illustrated represents one of several methods now in use for economical production.

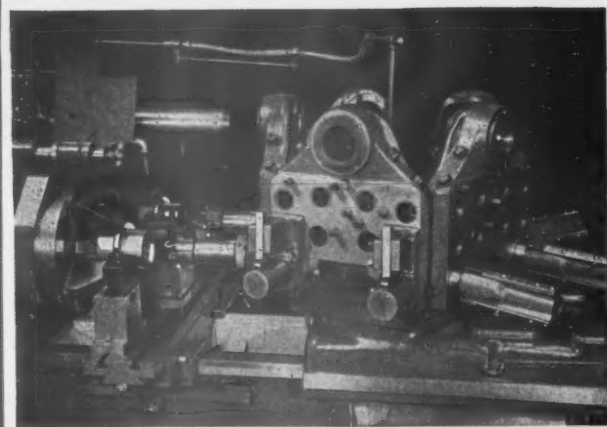


6DREL—Single Spindle Potter & Johnston Automatic, also equipped with special tooling arranged for the speedy and efficient handling of one of the principal operations on Aircraft Engine crankshafts. Full particulars and complete details will be sent upon request.

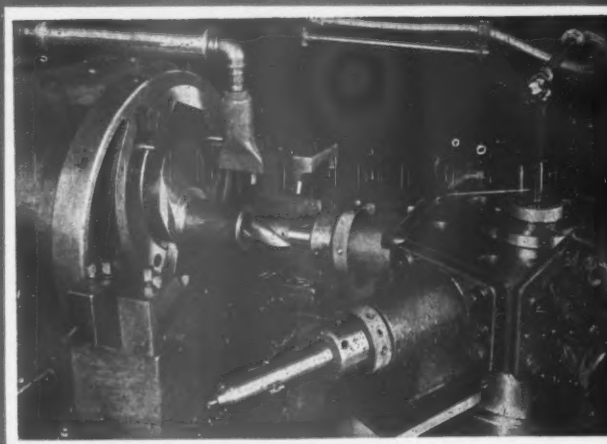


AUTOMATICS

PROVIDE SOLUTIONS TO
AIRCRAFT ENGINE
PRODUCTION PROBLEMS



AIRCRAFT ENGINE PARTS
CYLINDERS — PISTONS — MASTER RODS CYLINDER
HEADS—CAMs—REDUCTION GEARS—CRANKCASES
—CRANKSHAFTS—AND MANY OTHERS ARE ECO-
NOMICALLY PRODUCED AT HIGH RATES OF SPEED
ON P & J AUTOMATICS.



POTTER & JOHNSTON MACHINE COMPANY

PAWTUCKET, RHODE ISLAND

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Jenison Machinery Co., 20th and Tennessee Sts., San Francisco; Wessendorf, Nelms & Co., Inc., 320 Franklin Ave., Houston, Texas; Arthur Jackson Machine Tool Co., 60 Front St., West, Toronto 2, Ontario; Arthur Jackson Machine Tool Co., 437 Grosvenor Ave., Montreal, Canada; Burton Griffiths & Co., Ltd., Birmingham, England; R. S. Stokvis et Fils, Paris, France; Rotterdam, Holland and Brussels, Belgium; Maskinaktiebolaget Karlebo, Stockholm 1, Sweden; Ing. Ercole Vaghi, Milano, Italy; Yamatake & Co., Ltd., Tokyo, Japan (Imperial Export Co., 44 Whitehall St., New York, N. Y.); Almacoa, Zurich, Switzerland.

Perhaps the best example of finish is in our Connecting Rod Department where previously nearly half the men in the department were engaged in polishing and bench operations to remove all tool marks and sharp edges. However, with our increased volume we have been able to change much of this hand work to machine operations and still get the high degree of finish. Our master rod requires some 120 operations to complete the part, of which 60 are machining operations and balance are polishing, bench, heat treat, inspection, etc. As you probably know our master rod fits over the crankshaft throw on a steel backed copper lead bearing and the articulated rods to the other cylinders are attached to the master rod through knuckle pins. We found that as the H.P. of the engines increased that the flexing of the master rod at each explosion caused a minute movement between the rod and press fit bearing and knuckle pins with the result a galling action occasionally took place that might start a crack resulting in failure of the part. To correct this we first honed the hole in master rod to insure as perfect a round and smooth hole as possible but when this did not eliminate all galling we had to follow this honing up with chrome plating and another honing operation. This hard chrome surface successfully resists the galling action. Compared to this hard surface on the rod we have an extremely soft surface in the lead bronze bearing which requires that this dimension be the last to be machined so that it will not be scratched. In fact we do not allow the use of solid plug gages for checking the final bored hole but check it with expansion type plus gage. We have many parts which we must finish grind the locating dimensions used for previous operations as the last step because putting the part on and off fixtures would cause scratches requiring rework of the part or even scrapping the part. On our master rod we find it necessary to insert all the press fit knuckle pins when boring bearing to final size as these pins distort hole slightly when pressed in.

24 Different Operations in Finishing Simple Cap Screw

Highly stressed studs such as those used to hold cylinders on crankcase must be held to such precision on thread form and pitch diameter that we can only fabricate same satisfactorily on thread grinders. Most studs must have a taper on the first two or three threads so that the strain at bottom of hole in casting will be relieved to eliminate possibility of starting cracks. A simple cap screw used to hold cylinders to crankcase on one of our models requires 24 different operations of which 9 are machining, six are heat treat,

four bench and burr, washing, plating, inspection, etc. This particular cap screw is used 280 per engine and is so designed that the hexagon head must be milled as weight would be too great if we made this part from hex stock giving sufficient bearing area against cylinder.

Over 80% of our spur gears must have ground teeth because the slight distortion that occurs while hardening would not allow uniform satisfactory performance in the engine at high speed. Nearly all these gears must be hardened on power quenching presses to eliminate distortion. Outside diameter of teeth, sides of teeth and gear webs are ground if at all possible to eliminate tool marks. Some idea of the care we must build into our gears can best be exemplified in our reduction gear where we transmit 1,700 H.P. through 10 pitch teeth less than one inch wide. Many of our splined parts have the splines ground after hardening including some of the internal splines such as our reduction driving gear that fits on the crankshaft. On gears and many of our small parts we must be constantly on the watch to stop corrosion of finished surfaces, especially during the humid months. Even slight corrosion caused by perspiration from operator's hands will often cause a pitted condition resulting in the reworking or scrapping of the part and after many finish grinding operations we find it necessary to dip parts in rust preventive and after final inspection we degrease and carefully coat with rust preventive.

Our crankshafts are not only carefully machined to close tolerances and polished all over except running surfaces which are honed or lapped but after each assembly each shaft is balanced on a dynamic balancing machine and metal removed by drilling so that each shaft is in perfect balance when running in the engine. To further eliminate engine vibration the counterweights are designed so that they oscillate with each explosion and the pins supporting the counterweights on only a line contact must operate under centrifugal force of 5 to 6 tons which demands a very high degree of finish on pins and bushings. On the crankshaft and on many other parts the threads for thrust nuts, etc. are ground and it is necessary to remove the incomplete thread at each end to eliminate seizures of thrust nuts and possible failure.

Cylinder sleeve is machined from a forging weighing approximately 70 pounds but after machining weighs only about 12 pounds and this illustrates the large amount of material that must be machined off many of our parts. On this sleeve we machine some 41 fins approximately .022 thick and $\frac{5}{8}$ " deep at one plunge cut in the nitralloy steel that has

been heat treated up to 250 Brinnell hardness. The inside surface of our sleeves is hardened to resist piston wear by the nitriding process which produces a very hard surface only a few thousandths thick. As we get a slight distortion during hardening and a large distortion when we shrink barrel into the cylinder head where the threads are about .014 smaller than on the sleeve, it was necessary to work out a method of cam form grinding the inside diameter of barrel before nitriding so that after assembly we can get a perfectly round bore by grinding out only .002 or .003 stock.

Success of Program Depends on Tool Engineer

One of our most important inspection checks is the magnaflux process through which all our highly stressed steel parts are passed. Roughly the magnaflux process consists of magnetizing a part and immersing or flowing over the part a liquid containing finely divided iron particles. The most minute crack or check in the steel forms the two poles of a magnet which attracts and holds some of the fine iron particles thus making plainly visible defects that cannot be seen by a high power glass or even by etching. The introduction of magnaflux into our plant some five or six years ago necessitated a considerable change in many of our grinding operations, especially shoulder grinding as we found we were actually causing minute cracks by our old grinding practice. However, by proper selection of wheels, speed, coolant, etc. it was possible to eliminate at no extra cost these defects that might occasionally result in failure of parts.

The few parts and machining processes I have just mentioned briefly, are of course, only a sample of the care that must be taken in the fabrication of parts for aviation engines that are so important to our National Defense program. I have tried to touch on as many general points as possible to give you a picture of the job that we and many of you have ahead in expanding such a new experimental industry into one of the major industries of the land. There will be difficulties in training machine operators, possibly in the procurement of materials, but I believe our success in meeting this vital program depends chiefly on two points. First, the ability of the machine tool industry to deliver the machines necessary for this program and second the ability of the tool industry in general, of which you are a part, to design and provide in time the most efficient types of tools necessary for the production of these high precision parts with relatively unskilled labor. This tooling must be done in a few months time and the aviation engine industry must depend on such Tool Engineers as you to really put this job over.

Marine Engines

Their Production Presents Special Problems



How Tool Engineers are now increasing production in one working unit of our Defense Program

by J. A. ASHBURN

PATROL Torpedo—a new type of naval craft is now operating in Atlantic waters. Nicknamed the “mosquito fleet”, these light, speedy craft can patrol large areas and are equipped with several deadly torpedoes. The government will not permit publication of the actual speed of these new boats, but they are capable of speeds far in excess of fifty miles an hour.

To power these PT's a marine engine of unusually light weight and high power was required. This engine, which weighs 1950 pounds stripped and has a rated horsepower of 1350 at 2500 R.P.M., was developed and an experimental contract for seven motors given the Packard Motor Car Company in May, 1939. They were built with tool room equipment and proved satisfactory in test. The link type connecting rod was abandoned in favor of a fork and blade type; and an entirely

new supercharger of unusually high precision was developed.

Convinced of the desirability of a fleet of these boats, the navy placed an order almost immediately for eighty additional motors and several other contracts have been placed since then.

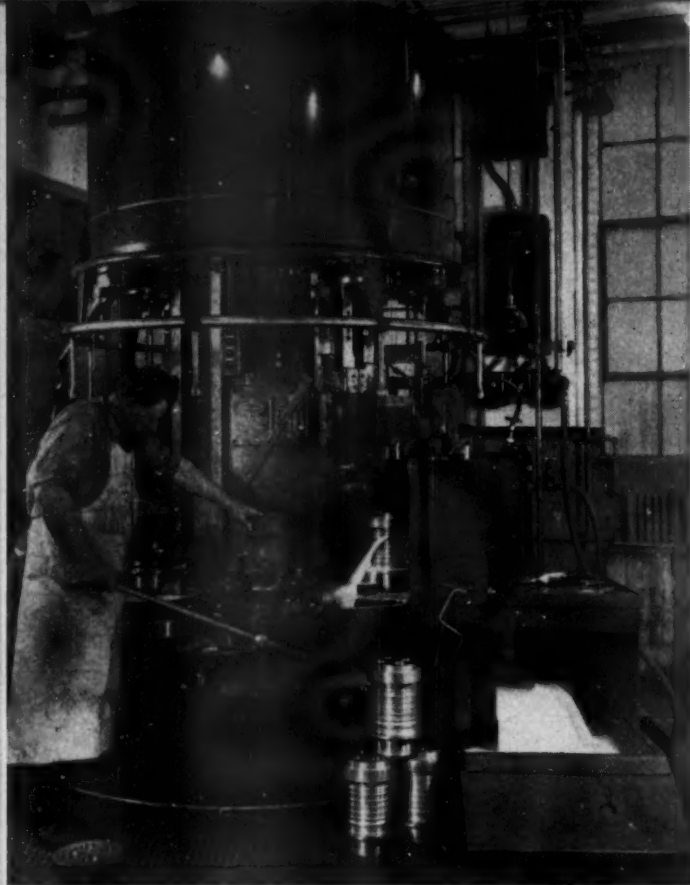
To manufacture these engines has been a continuing problem for Tool Engineers. Rather than merely add more men and use old methods, production machinery was introduced as soon as the second contract was placed. As the rate of production has been stepped up more and more of the mass production technique has been introduced, even though the engine does not lend itself to the true assembly line.

In some instances tool room equipment was found to be more expedient because of the high precision and the relatively

limited production. In machining the supercharger precision was imperative, as the holes bored in the three large units must be in alignment with the crankshaft when assembled. A jig borer proved the best solution, even though it is strictly a tool room machine.

Production of this engine, of course, is still proceeding largely by methods considered somewhat cumbersome by Tool Engineers associated with industries where production mounts into the millions annually, yet it represents new efforts to apply the production tool and the technique of mass manufacturing to a new field. Used as a training ground for men for the new Packard Rolls Royce plant it may help bring to the aviation engine every mass production idea commensurate with the high quality involved.

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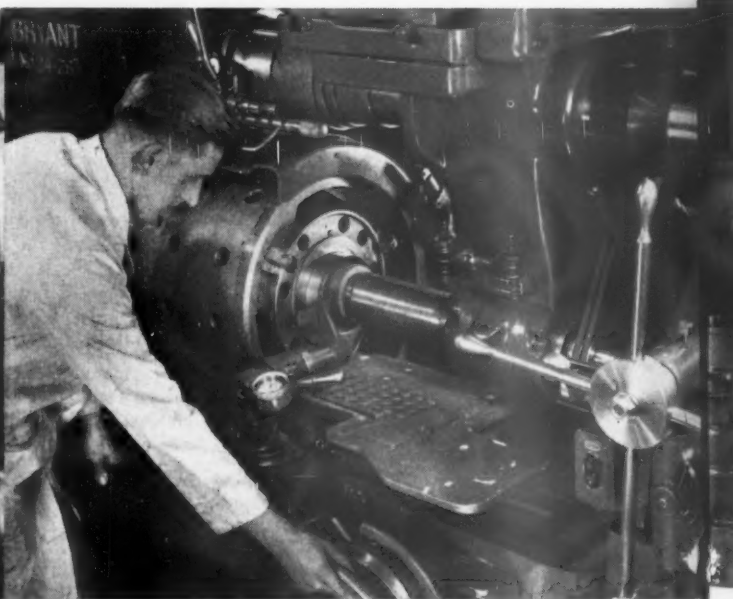
CYLINDERS ARE BORED on their inside diameter and turned on their outside diameter by this Bullard 8-spindle lathe. Six cylinders are machined at once; two spindles are for loading.

ALREADY IN PRODUCTION OUTPUT IS NOW TRIPLING

THE PRECISION which must be built into a marine engine is comparable to that required in an airplane engine. Parts are generally kept at minimum weight and hence are frequently stressed near their capacity. To prevent failure of parts, which might result from minute scratches or tool marks, all surfaces in the engine are finished ground except a few small parts not under high stress. All steel parts are magnafluxed before assembly to insure unimpaired surfaces. Piston pins are Superfinished. Profilometer readings are taken on all the ground surfaces. The cylinder barrels, connecting rods, crankshaft, and gears are steel. The remainder of the engine, about three fourths of the total, is made of strong aluminum alloys. Each casting is thoroughly examined for flaws before machining is begun in order to prevent the waste of time involved in finishing a worthless casting. In machining aluminum parts it is necessary first to take a roughing cut, heat treat to relieve strains, and then the finishing cuts. Completed aluminum parts are oxide coated before assembly to prevent corrosion. A difficult welding operation is performed when the stainless steel waterjacket is welded around the cylinders to form a seal which is watertight through the wide range of temperatures involved. Bearings are lead-tin plated to prevent scoring while running in, and main bearing holes are diamond bored. Production of these engines takes place in a building entirely devoted to their construction. Heavy machines are located on the first floor and light machines on the third, with finished parts converging to the second floor where they are assembled. From the initial order for seven engines, production has been steadily increasing. About a hundred and twenty-five of the engines have already been produced and more than seven hundred of them are now on order. The plant is producing nearly two a day at the present time and should reach three by May 1st, 1941.



GROUND SURFACES are required on all highly stressed steel parts to insure surfaces free from tool marks or scratches which might result in failure. The faces and crankpin hole of the connecting rod fork (left) are precision ground in a Bryant



ant two-spindle grinder. The cylinder bore is finish ground (right) after it has been bored on the lathe shown in the upper left cut on this page.

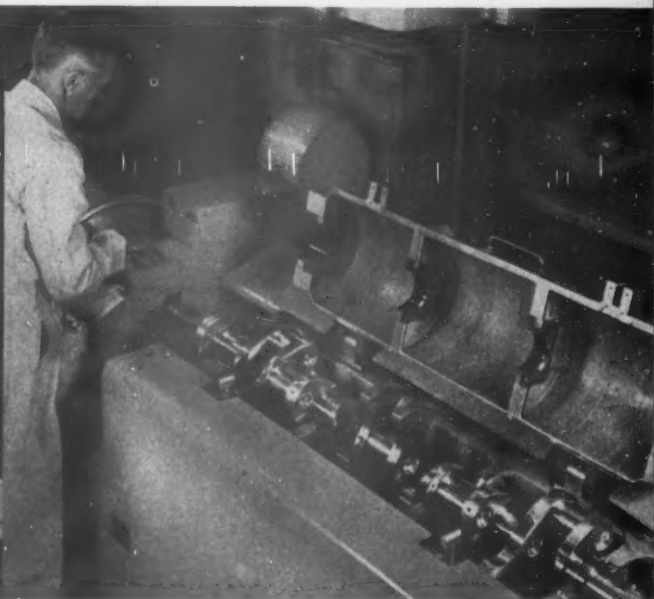


CONNECTING RODS are machined, three at a time, on this Pratt & Whitney Keller Machine. A stylus following the contours of the master rod at the top guides the three high speed steel cutters at the bottom in machining identical rods, (10 a day).

THE CRANKCASE has been minutely examined for any possible flaws in the casting before holes are drilled and reamed on this radial drill press. Note holding fixture which is designed for indexing casting into proper position.



CYLINDER BORE is checked with a micrometer indicator. Notice how the stainless steel waterjacket has been welded to the cylinder barrel. This weld forms a water tight seal which resists any stresses put on it by the wide temperature range.



BALANCING CRANKSHAFT is operation performed in this crankshaft balancer. It must be done within extremely close limits of accuracy since the least unbalance might rip the engine to pieces when it is running at full speed of 2500 R.P.M.



CAREFUL MEASUREMENT of all parts is required to insure proper fits when they reach the final assembly room. Even slight errors might permit strains which would result in engine failure. Above: Hoke blocks are used with a micrometer height gage to inspect connecting rods. One difficult operation encountered was drilling and boring the bolt holes through these connecting rods. Their length, coupled with a diameter of only $7/16$ " made holes which were true and free from tool marks difficult to obtain. A small boring bar with minute cutter which gave the desired result was developed.



A GRINDING OPERATION is performed on the connecting rods with a Brown & Sharpe Grinder. There are two types of rods, since it is a V-type engine. Shown here is a forked rod. A blade rod from the paired cylinder will mesh with this.



MAGNAFLUXING crankshaft to detect minute flaws. The shaft is magnetized and sprayed with a solution containing small iron filings. Any scratch forms two poles which iron marks.



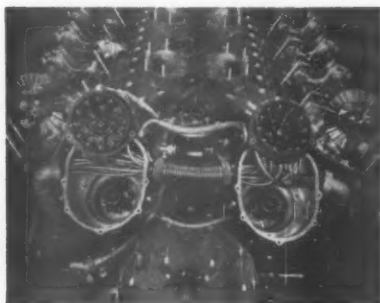
PRELIMINARY ASSEMBLY of the crankshaft (demagnetized after magnafluxing) and connecting rods. This assembly is real "guts" of engine and heaviest stresses are concentrated here.



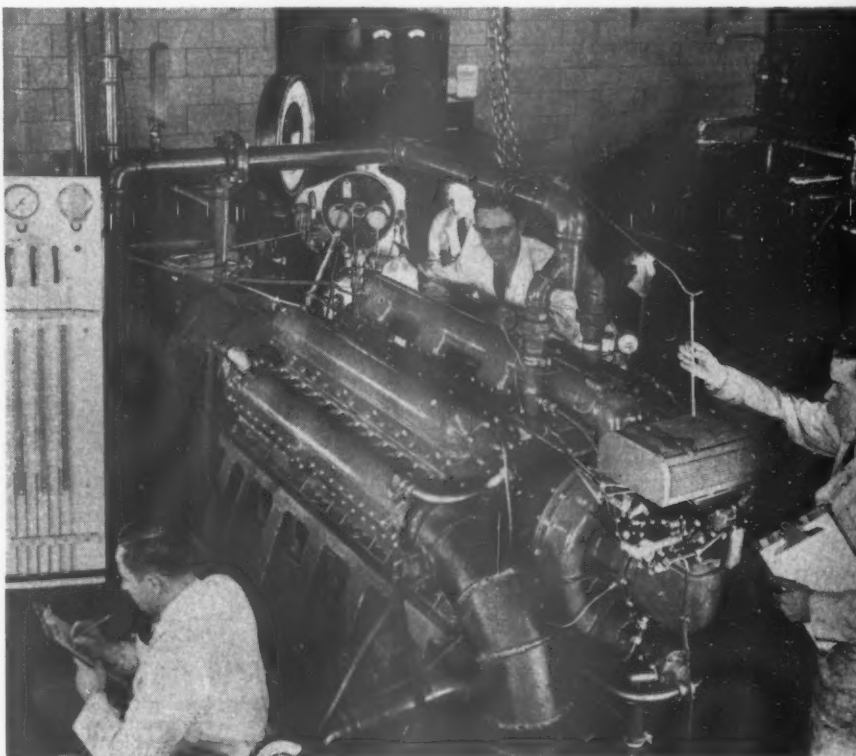
CYLINDER BLOCK is lowered into position on the crankcase, which is mounted on fixture adjustable at any angle needed.



FINAL ASSEMBLY takes place in an air conditioned, dustless room. Every part has had its measurements carefully checked and rechecked before it enters this room. Surfaces have been tested and then cleaned thoroughly. No abrasives or grit of any type is permitted in this room. After the completed engine has been run in it is returned to the assembly room where it is completely disassembled and each part is examined for any flaws which may have developed while running in.



THE ELECTRICAL SYSTEM is shielded to eliminate radio interference. As a safety measure flame trap screens are placed at inlet valve ports. **Right:** The completed engine is run in on a dynamometer set-up. Power is first supplied by an exterior electric motor which turns the engine over at 600 R.P.M. for about two hours and a half. This jacking in is followed by a speed-up to 900 R.P.M. by internal combustion. Running under its own power the engine is stepped up over a twenty-hour period to its maximum of 2500 R.P.M. It is removed from the dynamometer and returned to the assembly room where it is taken apart, checked, and reassembled. This is followed by an additional ten hours on the dynamometer in which the speed is stepped up at a faster rate. The engine is then ready for installation in a Patrol Torpedo Boat.



How Milwaukee Helps Train Craftsmen

By F. W. ZIEGENHAGEN

Vice Principal, Boys' Technical High School

and R. A. RADTKE

Supervisor of Industrial Arts

Milwaukee Public Schools

THE State of Wisconsin, and the industrial leaders in Milwaukee in particular, have always taken a keen interest in the training of apprentices in the skilled occupations. For many years the Industrial Commission of this State has worked on the development of codes and practices for apprentices so that now these plans are considered models to many other States in the Nation. In fact the people in charge of the Federal apprenticeship training program have used the Wisconsin plan as a model in many instances.

It is well known that the nation at present is faced with an important problem in

building up the depleted ranks of skilled craftsmen. For years, our country has relied on obtaining skilled craftsmen from European nations. This source of supply has stopped. Moreover, the apprenticeship training program was severely curtailed during the past decade due to the depression. Also, new production methods, especially in the metal trades, has brought demands for craftsmen in the tool and die industry far in excess of the supply. Since the training program has not kept pace with retirements and deaths in this highly skilled trade, it is apparent that concentrated efforts must be made now to remedy this

craft shortage.

To this end the trade and vocational schools can be of great assistance, if closely integrated programs of selection of apprentices are organized between industry and the schools.

The Boys' Trade and Technical High School of Milwaukee was organized by interested industrialists in 1906 to relieve the shortage of skilled mechanics which then existed. After three years of successful operation the school was taken over by the Milwaukee Public School System. The school for a time operated as a trade school only; however, in 1918 a regular accredited high school was added, so that now the school has two divisions; the purely trade division and the high school division. During the last decade a large percentage of students finished not only their skilled trade, but also the regular academic high school requirements. Students, who finish only the high school work, must however, major in shop work and mechanical drawing—a requirement for graduation. Those students who take the trade and regular academic high school course require from five to five and one half years to complete their work. The rate of progress depends upon the ability of the student. Since the reader is perhaps more particularly interested in what work is covered by the student in the machine shop course, involving tool and die practice, the course of study is briefly outlined.

This includes the required work for both the trade and high school course, which the student may carry on simultaneously. Students must be sixteen years of age before they are permitted to enter any trade division.

The required academic subjects are as follows:

English	6	Semesters
Mathematics	4	"
Science	2	"
Social Science	2	"
Physical Education ..	4	"
Elective	English, Math, Science, Music, etc. to make at least 20 credits excluding shop and drawing credits.	

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Henry and Ford, Twins—Seniors at Trade School



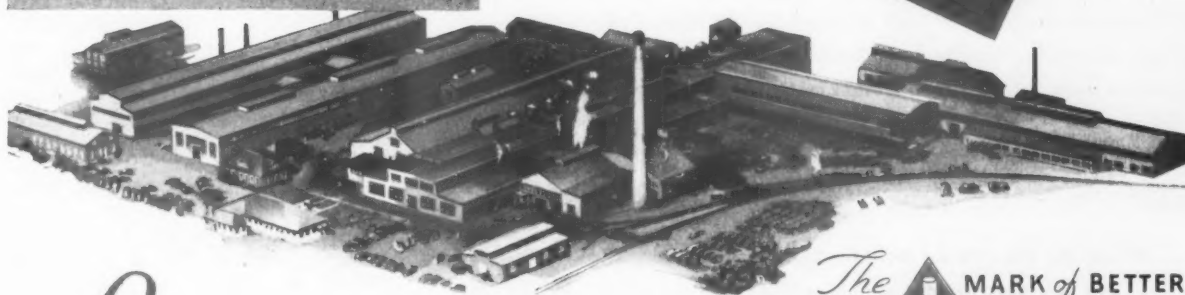
Much of the valuable work being done in the training of craftsmen in this emergency is the work of municipal schools such as the Milwaukee Boys' Trade and Technical High School. Among other leading industrial trade schools is one founded by Henry Ford. The senior class this year includes the two youths shown above doing shop work at a boring machine. They are Henry (Left) and Ford Lawrence, 18-year-old twin sons of Mr. and Mrs. Frank Lawrence. They got their names because they were the first twins born in the Henry Ford Hospital.

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HOW MILWAUKEE HELPS TRAIN CRAFTSMEN

(Continued from preceding page)

In addition to this academic work related machine mathematics, including trade trigonometry, and shop theory is required.

The practice work covered in this course is as follows:

1. *Drill press work*, including drilling with jigs and fixtures.
2. *Lathe work*, covering Universal and four jaw chuck, turning tapers,

straight and taper boring, right and left hand threading, special thread cutting—V. —N. C., N. F. & N. S. Square, acme, double, triple, quadruple, and sextuple.

3. *Shaper work* covering shaping irregular surfaces and dove-tail shaping.
4. *Milling machine work*, covering, plain and differential indexing, fluting reamers, work with fly cutters, milling gears, spur, bevel, spiral, worm and worm wheel, milling, hobbing worm wheel, and stagger indexing.
5. *Planer work*: covering horizontal surfaces, irregular surfaces, key seating, and squaring.

6. *Grinder work*: covering surfaces, cylindrical, and internal grinding, grinding shaper and planer tools, grinding relief on reamer and milling cutters, taper and angle grinding.
7. *Automatic gear cutting work*—covering cutting spur, bevel and mitre gears.
8. *Jig borer work*: covering spotting, milling, use of tilting rotary indexing table, single point boring, and end mill reaming.
9. *Special work on tools*. Each student is required to complete work on reamers, cutters, angular milling cutters, gear hobs, drill jigs, and thread-size, plugs and collar, and work on jigs and fixtures.
10. *Tool forging and heat treating*—covering forging chisels, and punches, lathe, shaper, and planer tools, hardening and tempering of carbon and high speed steel, hardening milling cutters, reamers, taps, etc.; case hardening, use of pyrometer, etc.

Specialized machine drawing covering about 400 hours of work, closely correlating the shop work is also required.

This covers our training program at the Boys' Trade and Technical High School in the machine trade department.

Now what about placement and follow-up work. The Instructors and Administrators of the school keep constantly in touch with personnel men in industry trying to place the right boy in the right place according to his ability. However, during the last decade this was not always possible due to irregular plant operation. This also made follow-up work rather difficult. Students would be placed, but just as soon as work would be slack they would be laid off.

We have also worked closely with industry in the apprenticeship training program. However, due to irregular plant operations, not many apprentices could be indentured. Many industries in Milwaukee allow the graduates of the Boys' Trade and Technical High School one year credit on a four year indenture, while some place them as special learners in their plants.

With the preparedness program under way we feel that trade schools can assist materially in training skilled workers for industry. First, they can prepare young men in the fundamentals, of machine shop practice. Secondly, they can specifically point out the student's aptitudes. Thirdly, they can, with industrial coordination assist materially in stepping up the training of skilled mechanics.

Not all trade schools are equipped to give good practical trade instruction, but those that are, we feel sure can be of great assistance in helping overcome bottlenecks in many trades.

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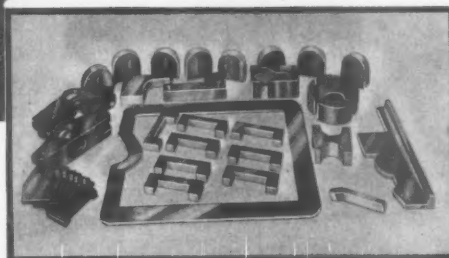
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The DoAll is the rugged machine tool that effects such sensational savings in time, labor and material. Takes the place of lathe work, milling and shaping in thousands of plants. Now used in 30 countries for cutting every kind of metal in automobile factories, arsenals, ship yards, aeroplane plants, machine shops, etc.



SPEEDMASTER



An important part of every DoAll Machine. Gives instant variable speed.

A compact unit, also sold separately for use on any other machines requiring variable speed. Produces any speed, 6 to 1 ratio, by mere touch of handle.

JANUARY, 1941

Let us send a factory trained man to your plant to show you what a DoAll can do and save for you.

FREE—Handbook on Contour Machining, 158 pages of valuable metal working helps.

CONTINENTAL MACHINES, INC.

1304 S. Washington Ave. Minneapolis, Minn.

CONTINENTAL BAND FILER

Does continuous filing, which means faster, better, smoother filing on all materials from toughest high-carbon steel to soft brass, wood, etc. Available are 12 styles of file bands, $\frac{3}{8}$ " and $\frac{1}{4}$ " wide—flat, oval or half round. Ask for circular.

Handy Andy Says—



WHILE this is written during the lethargy following Thanksgiving, and with Christmas still in the offing, it won't get to the readers until the New Year has shed its swaddling clothes. So, while comments and greetings are anticipated, arrival will be Seasonably belated. In passing, however, I

would express the thought that this past Thanksgiving was truly a day in which to be grateful for peace and the fruits of peace in our own land. So far, at least—but now dark clouds threaten, and tomorrow . . . ? But let tomorrow bring its own problems. "Ah, fill the Cup:—what boots it to repeat How Time is slipping underneath our feet: Unborn TOMORROW, and dead YESTERDAY, Why fret about them if TODAY be sweet!"

Now, I extend to our readers the best wishes of the Season; a Merry Christmas and a Happy and Prosperous New Year to all. May we grow in mutual regard and go onward to bigger and better things. Skoal!

The Society is growing at such a rate that, while "auld acquaintance" are not forgot, I have had to relinquish the "personal touch" lest mention be confined to a more or less limited circle. Oh, there'll be exceptions, no doubt, as when the clan convenes semi-annually or a name from the past stirs recollection. But you know how it is; like many of our members anchored to a mooring (the rolling stone having decided to gather moss, to mix metaphors) I may be a personality to the boys who know me, as they are personalities to me. To the for-the-nonce stranger if potential friend in a remote Chapter, however, one may be just a name that may or may not be impressed on the memory. Not that one need be a stranger in this A.S.T.E.; there is too much good fellowship for that, and besides, we are bound together by common ideals and objectives. Say, then, that in this Society there are many friends who just haven't met as yet.

BLANCHARD

Blanchard Surface Grinders are cutting costs and improving quality on both production and tool work



THEY are massive, powerful machines with ample weight of metal where it is needed for rigidity. Their controls are convenient and easy to operate. They generate a flat surface by the rotary motions of work and wheel—this makes wheel truing unnecessary and saves cost and time, especially when grinding from the rough.

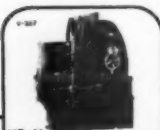
Since Blanchard Grinders practically eliminate set-up time, the output per machine is high, even with an average operator.

A new development is the production of very fine finishes by Blanchard Grinding. If your work requires flat surfaces with a finish of a few microinches (by profilometer) the No. 11 or No. 18 Blanchard Surface Grinder with fine grit wheel, made by Blanchard, will produce them for you.

To keep Blanchard Grinders at maximum efficiency, it pays to use wheels manufactured by Blanchard.

A General Catalog covering the complete line of Blanchard products, or catalogs on any specific Blanchard product, will be sent on request.

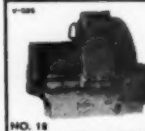
THE BLANCHARD MACHINE COMPANY
64 STATE STREET, CAMBRIDGE, MASSACHUSETTS, U. S. A.



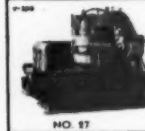
NO. 11



NO. 15



NO. 18



NO. 27



NO. 16A



NO. 16A2



NO. 16A DUAL



BLANCHARD WHEELS

Looking down the imposing array of Chapters, I run across familiar trails. Once, I spent a few days in Houston, although I usually worked out of Dallas. That was about the time that McCurdy flew to Cuba and Henry Ford introduced the Model T and the corner barber shaved me free, being sort of ashamed to charge for nothing. (Now you know just when it was). There weren't so many machine shops around the Lone Star State then, and little thought that there would eventually be mass manufacture to warrant a Chapter of Tool Engineers. Not that there wasn't progress and enthusiasm, and Houston—well, "It will be a great seaport some day, maybe". Now look at it! At that, I came pretty near staying in Texas, a chap having offered me a share in a little machine shop that has doubtless grown to big proportions by now. But, I was corresponding with a little blonde up North, although we eventually stopped writing except on rare occasions. You see, she figured it was easier to marry me than to read my scrawl. Anyway, greetings to the Southland—and I don't wish you snow for Christmas. Instead, may the orange blossoms smell their sweetest.

Speaking of snow reminds me that, while touring north and through Minnesota late last summer, I subconsciously noted the second growth timber and as subconsciously compared it with the generation which has succeeded the old pioneer stock. And, at first impression, it seemed weak compared to the sturdy fibre of the parent stock. Yet, the old had its beginning, too, and the strong crowded out the weaklings until only the giants remained. It will be that way as

(Continued on following page)

"LOGAN"

SURE FLOW CENTRIFUGAL PUMPS ★ ★ ★

"LOGAN" Sure Flow Pumps are adaptable to an unusually wide range of service. They pump hot or cold liquids; and safely handle chips, filings, abrasives and most corrosive impurities. Model SFM 100, illustrated at right, is SELF PRIMING and can be mounted entirely away from the source of supply. No part of the pump need be submerged. No priming reservoir, foot valve or check valve is needed.



FLANGE MOUNTING for DIRECT INTAKE FROM SUPPLY TANK

Model SFM 300, illustrated at left, is designed for direct mounting on the side of the supply tank, or for installations when streamlining or lack of space prevent the use of an exposed intake line. Intake is direct through the flange base. The "LOGAN" Sure Flow Line is complete — 10 sizes, 4 to 150 GPM . . . with power applications and mounting styles to fit every pumping job. Write for Catalog No. 60 showing complete line and specifications.



LOGANSFOWT MACHINE, INCORPORATED
902 Payson Road
Manufacturers of Air and Hydraulic Devices, Chucks, Cylinders, Valves, Presses and Accessories
LOGANSFOWT, INDIANA

HANDY ANDY SAYS

(Continued from preceding page)

long as there are people on earth, regardless of reformers and Utopians. People were never intended to be alike, or we'd all have been created that way; as it is, some of us are born smart, more average and the most sub-average and sometimes (waxing pessimistic) I think that the latter are going to inherit the earth and the Kingdom after all as long as they can get it for nothing and are encouraged along the lines of least resistance.

I remember when immigrant stock came here to work, and had plenty of

competition from the natives (?) more remotely arrived, but of late the masses of the people have been led to think that we can have national prosperity by laying down on the job. But when you come right down to it human nature hasn't really changed. Only the viewpoint has and warped perception may be due to a passing fog of collectivism. Working with the boys around the plant, I notice that individuals among toolmakers, machinists and production hands still have their pride in workmanship and have by no means over-subscribed to the watered stock of slowed down production. And that, gentlemen, bodes well for the future of our people. We will have to have faith in their inherent qualities and find comfort in the thought that, among the

second growth timber, there are big trees in the making. And even if the majority of the scrubs should sway to the Big Wind and join the moaning chorus for more pay with less work, the Tool Engineers can make up the difference by evolving ways to produce more at less cost and with less of toil. We just can't take the world as it is; our job is to make it better for all of the people. Onward to bigger and better things!

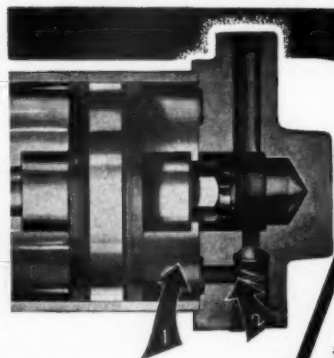
Now, I am by no means living in the past, my way of expressing though regardless. Any man who plans for the future must of necessity be of the realm in which he operates, even though he be an octogenarian who signs a 99 year lease. But, just as yesterday is the gage of comparison for today, so today is the standard by which to measure tomorrow. We can look back on past experience and see failure as well as success, and we can see why some things failed and others went over. Or, we can delve into the histories of past civilizations and even recent nations-that-were, and in the reading resolve prophecy for the final results of many present-day economic and social experiments. And when we do that, we will find that there is really nothing new under the sun; it was there all the time only in a cruder state. Little that is being tried today has not been tried before, from collectivism to free enterprise, from totalitarianism to democracy.

Cultures have had their peaks and recessions, and some have died or remained decadent, but those that are great today are great because of a renaissance of free enterprise or because of the native spirit of progress of the people. The Aztecs had collectivism, and it disintegrated at the first impact with steel; Athens was a brief epoch in millennia of drab Greek history and Plato's "Fifth Republic" may well have inspired Hitler's Third Reich. ("That too, will pass away"). The point is that, of all social experiments and ideologies of the past, the only tangible thing that remains is the direct evidence of work, be it a book or a thought passed on, a fragment of art or the ruins of a once great edifice. And bear this in mind, that our greatest gifts have come from the liberal minded, the independent thinkers. That holds true of what ancient Rome and Greece has taught us; it is true of the leaders of the Renaissance, the heretics and the dissenters with orthodoxy. It is true of America, a nation founded on freedom of conscience and freedom of enterprise. We first thought of a way, and then made the way, the American Way. Strong men evolved it, and strong men will perpetuate it. For, it is the Better Way.

Yours for Freedom,
Handy Andy.

THE TOOL ENGINEER

NOPAK Self-Regulating



CUSHIONED AIR CYLINDERS

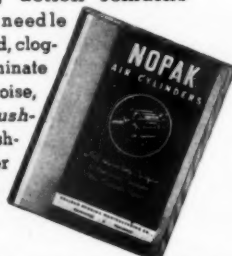
Meet Most Operating Requirements

Provide desirable features
of Constant Cushioning with
Smooth Gradual Action.

1. Built-in, Self-Regulating Air Cushion.

2. Quick-opening Air Duct assures quick starting under full power.

● Since their introduction late in 1939, industry has found more uses for the new NOPAK Air Cylinders with Self-Regulating Air Cushion than for the two earlier types combined. Here are a few reasons why: 1. The smooth, gradual, predetermined cushioning action remains constant. 2. There is no needle valve to be frequently re-adjusted, clog-up, or get out of order. 3. Eliminate damaging metal-to-metal impact, noise, shock and vibration. 4. They place Cushioned Air Cylinders in the non-cushioned price range. 5. Prolong cylinder life—cut maintenance costs way down. You, too, may find that this new type cylinder will fulfill most of your needs.



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2757 S. 31st Street • Milwaukee, Wisconsin

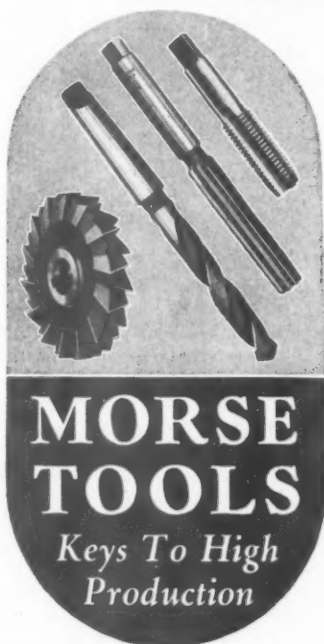
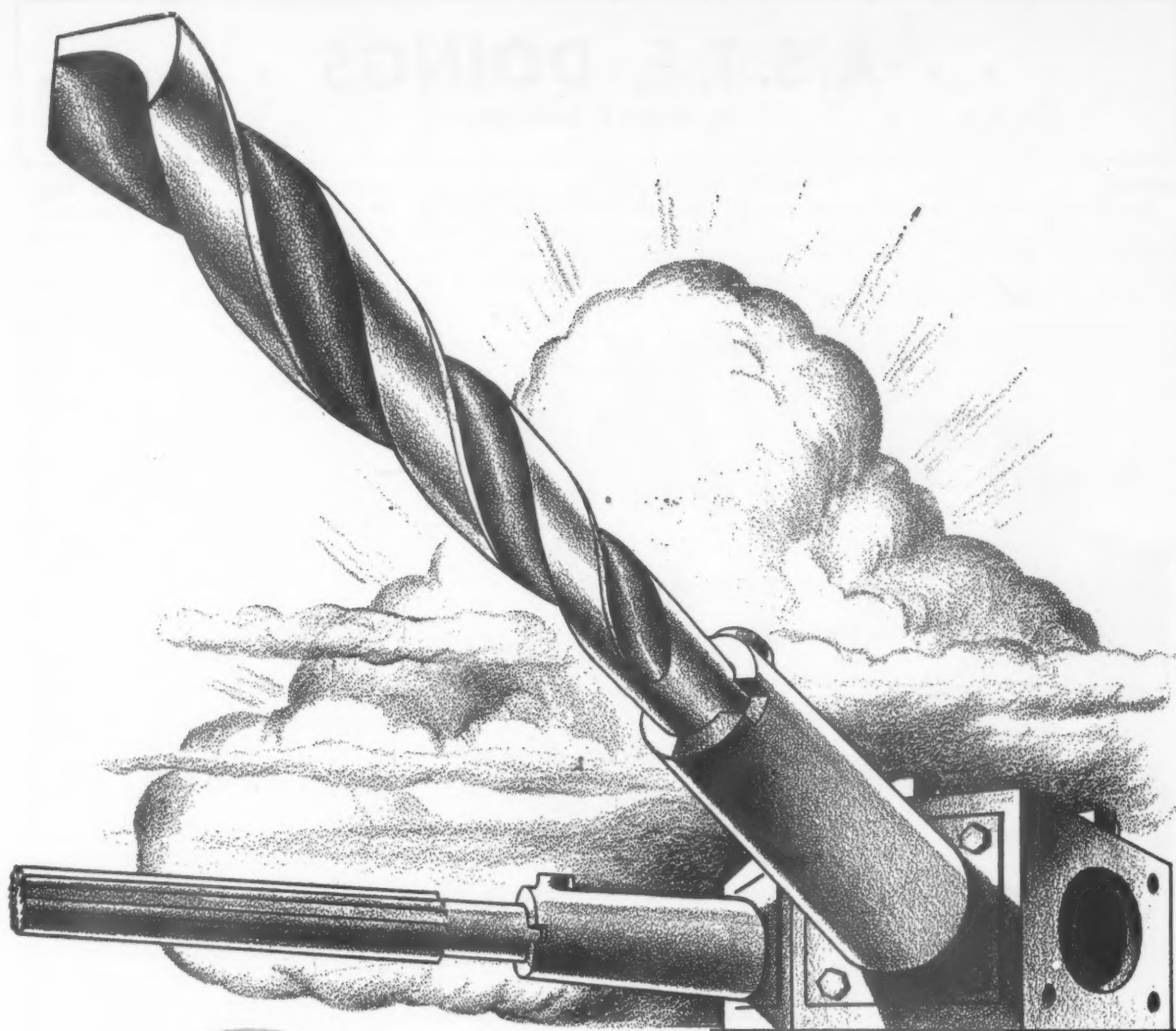
Consider All 3
Types—they're
fully described
and illustrated
in Bulletin 77.
If you haven't a
copy, send for it.

NOPAK

VALVES and CYLINDERS

DESIGNED for AIR or HYDRAULIC SERVICE

A3228-1P



Industry's FIGHTING TURRETS

Slip a drill, or reamer, or tap, or counterbore into a turret lathe, and you've got some of the best ammunition available to build our bulwarks of defense.

Because the efficiency of the mightiest machine depends upon the tool at its workhead, there is built into Morse Tools the high quality that insures maximum production. Morse Twist Drill and Machine Company, New Bedford, Massachusetts, U. S. A.

» » A. S. T. E. DOINGS « «

By IRWIN F. HOLLAND

Detroit

The Christmas Season was welcomed in by a record crowd when the Detroit chapter held their annual Christmas Party at Saks Show Bar on Thursday, December 12. Many old timers and officers were among the three hundred that gathered for dinner or the many others who dropped in during the evening to

join in the fellowship and watch the floor show. There were nearly twice as many present as at the party last year and those who went were agreed it was the best meeting of its kind in the history of the chapter.

Racine

The regular monthly lecture and din-

ner meeting was held at Hotel Racine on Monday, November 11. Approximately 50 members and guests were present.

Chairman Mr. Zaber introduced the speaker of the evening, Mr. G. E. Brumback, of the Carpenter Steel Company of Reading, Pa., where he is associated with the metallurgical department. Mr. Brumback with the aid of lantern slides very thoroughly explained and described "Tool Steels and their Selection."

Following the lecture the meeting was opened for discussion. Many and varied questions were asked by members and guests, and the speaker was well qualified to answer them. A rising vote of thanks was extended to Mr. G. E. Brumback.

Cleveland

"A capacity crowd of 794 members and guests attended the Cleveland Chapter No. 3 Annual Christmas party held in the ballroom of the Hotel Allerton on the evening of Saturday, December 14th, 1940. This was the largest and most successful Christmas party ever held by this Chapter.

The evening started with a turkey dinner at which time the Chapter presented a beautiful vanity mirror to all the ladies present and an elaborately bound program to the men. The featured speaker of the evening was none other than the famed Professor Oaks of Waukesha, Wisconsin, the expert on progress and invention. He gave a wonderful lecture and demonstration of his latest inventions which would aid all of us in the art of eating, playing golf, and lighting cigarettes. At the conclusion of the Professor's lecture the drawing for door prizes was held and the following prizes were presented:

\$25.00—Mrs. L. A. Jacob.

1 doll of questionable character—Mrs. Carl Hagerty.

1 quart bottle of Four Roses filled with cold tea—Mrs. J. L. Byrom.

The drawing was followed by an all star floor show of eight acts which was highly received by the crowd. The evening was then concluded by dancing until the 'wee' hours of the morning.

The party was a huge success and all the participating committees, under the able direction of Mr. Clete Briner, the Chapter Chairman, are to be highly complimented for their untiring efforts in putting the party over. The major worry of the Chapter, as it looks ahead to a new year, will be that of the accommodation of an increased crowd which will wish to

(Continued on following page)



LOOK into your PLANT

... There are probably
many jobs that could be
handled **FASTER . . . BETTER**
... and at **LESS COST** with
Hanna Cylinders

TODAY'S production schedules demand the greatest possible efficiency from both men and machines. Check over operations in your plant—perhaps much of the work that's now being done slowly by sheer physical effort or obsolete methods could be performed more quickly, safely and economically by a Hanna Cylinder.

For example, the practicability of Hanna Cylinders has been demonstrated in improving the operation of equipment such as presses—shears—clutches—valves—brakes—strip reel pushers—hopper gates—furnace and oven doors—material handling equipment—assembly fixtures—furniture clamps—damper regulation—hoists—any place where a push or pull is needed, either directly or through levers or toggles.

Hanna Cylinders are built in a wide range of sizes, for pneumatic or hydraulic operation. Write for complete details.



Model 4



Model 14



Model 17

HANNA ENGINEERING WORKS

1765 ELSTON AVENUE • CHICAGO, ILLINOIS
Air & Hydraulic CYLINDERS • Air HOISTS • Air & Hydraulic RIVETERS

*30,000 stampings
... no redressing*

... USING DIES MADE OF

NICKEL

ALLOY IRONS



OVER 30,000 STAMPINGS

without regrinding is the record of dies like these in the plant of a large Canadian automobile plant. Made by the Dominion Wheel and Foundry Co. of Toronto, these dies are specified in Nickel-chromium-iron.

IMPROVED ➔

and long service life in forming cold stampings from 0.10" steel is assured in these dies made of "Ryanite," a Nickel alloy cast iron produced by the Allyn-Ryan Foundry Co., Cleveland, Ohio. Strong, hard and wear resistant, also resistant to heat and mild shock, Nickel cast irons are readily machined.



20 TO 1 SUPERIORITY

over plain cast iron in production of washing machine tubs is claimed for these heat treated Nickel-chromium cast iron dies cast by the Youngstown Foundry & Machine Co., Youngstown, Ohio. Fine grained Nickel alloyed irons take a high polish, eliminate galling and streaking of stamped parts.



OVER 2 TONS

in weight is this large alloy iron die cast by Utica Steam Engine Co., Utica, N. Y. Fine grain structure, good machinability, high hardness and wear resistance are assured by use of 2.50% Nickel and 0.80% chromium in the mixture.

Inquiries regarding die compositions and other tool making applications are invited.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET
NEW YORK, N. Y.

JANUARY, 1941

A. S. T. E. DOINGS

(Continued from preceding page)

attend the party of 1941 following the magnificent affair just concluded."

Chicago

Despite zero weather, our December 2

Stag meeting brought out most of our charter members and an additional 200 members and guests.

The main attraction of the evening was a Technicolor Talkie, "Steel, Man's Servant", presented by the U. S. Steel Corp. Not alone was it an enlightening picture for the Tool Engineers' experience, but the photography in color was so natural

it made the spectator feel as if he were on the job when the steel was being made.

Round table discussions of present day tooling problems, community singing, musical entertainment, and refreshments provided a well-rounded meeting.

Plans were made for our annual dinner dance to be held February 1, 1941.

(Continued on following page)



Cleveland Chapter's 1940 Christmas Party Drew a Capacity Crowd.



New Tapping Head Quickly Pays for Itself

New "Procnier" High Speed Tapping Head Features Increased Output, Less Tap Breakage and More Accurate Tapping

In grueling tests on actual production work—this remarkable new High-Speed Tapping Head with the exclusive, "Tru-Grip" Tap Holder has broken numerous plant records for speed of tapping, accuracy and elimination of tap breakage. There are definite reasons for this: The Tru-Grip Tap Holder is so compact and light (weighs 1/3 of conventional tap holders) that fly wheel effect is reduced to a minimum. The Tapping Head offers dry, double cone friction clutch that won't wear, can't absorb oil and makes bottom tapping easy—three-point balanced heat-treated gear reversing mechanism that distributes pull and greatly reduces strain—and many other important features. Find out how this tapping head can quickly pay for itself in your shop—and solve your tapping problems!

SEND FOR BULLETIN

giving full details, description and prices on complete line of Procnier Precision Tapping Heads to meet all needs, the new TRU-GRIP Tap Holder—and also the full line of Procnier Universal Tapping Machines, hand, foot or air operated.

PROCUNIER
SAFETY CHUCK CO.

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Chicago, Illinois

Procnier Safety Chuck Co.
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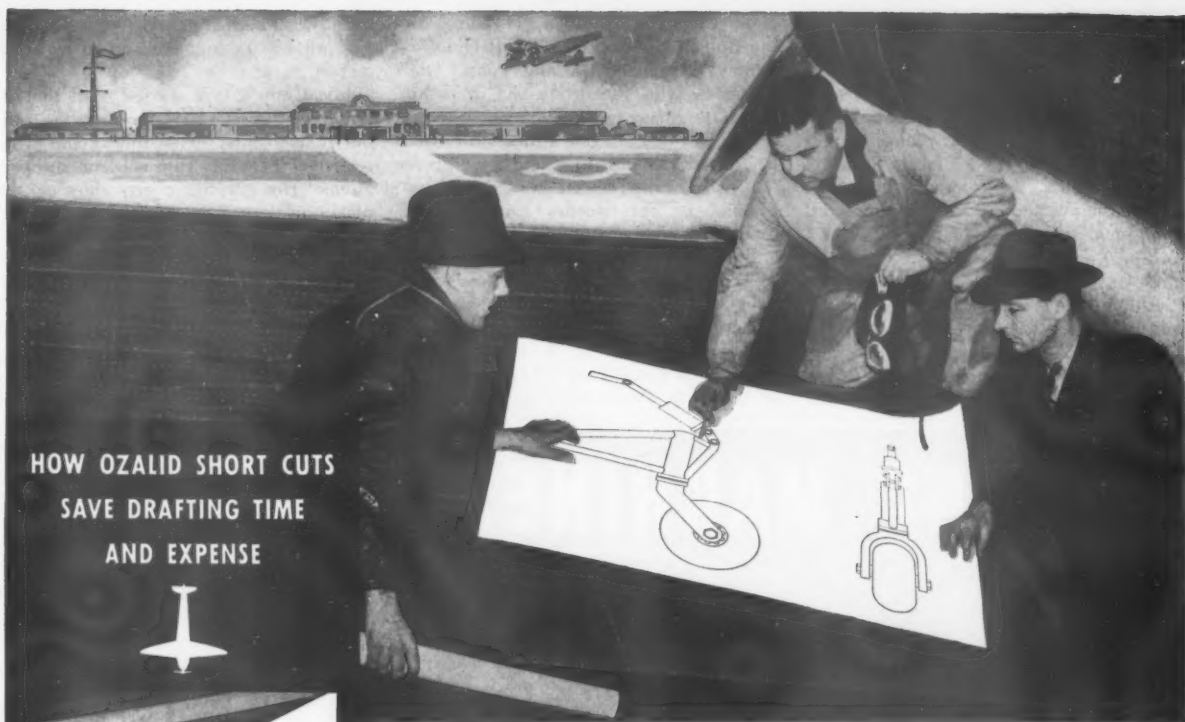
Send me Bulletins on: ☐ High Speed Tapping Heads ☐ Tru-Grip Tap Holders ☐ Universal Tapping Machines.

Name.....

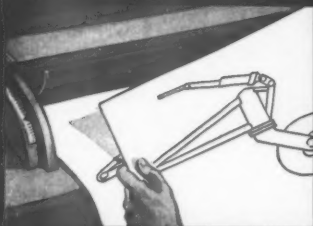
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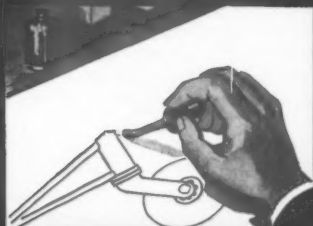
THE TOOL ENGINEER



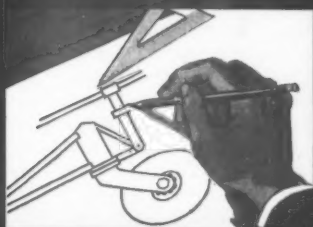
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NEW SPEED IN DESIGN CHANGES WITH *Ozalid* TRANSPARENT DUPLICATES

Industrial production zooms and drafting and design departments become jammed with work. Skilled machinists are scarce; good mechanical draftsmen scarcer. But undermanned and overworked drafting departments get a blood transfusion when they adopt the Ozalid Process.

No more difficult and exacting overlays—no more tedious and wasteful redrawing when Ozalid transparent duplicates are used. Delete that part of the design you don't want; add details in pencil or ink. Whole sections dropped out or just a few lines changed, it is all the same when reworking an Ozalid transparent duplicate.

Investigate how much "quick drafting" you can really do with an Ozalid machine in your print room. Send today for complete information on How Ozalid Cuts Drafting Time and Expense and also free booklet of dry developed Ozalid whiteprints.

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GENERAL ANILINE & FILM CORPORATION
JOHNSON CITY, N. Y.

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A. S. T. E. DOINGS

(Continued from preceding page)

This will be a gala affair, a cocktail hour preceding the dinner, a vaudeville act followed by dancing and music by a 10-piece orchestra. We are giving this affair lots of publicity and it should climax all other meetings of the year.

Pittsburgh

Although it is a little late, we of Pittsburgh Chapter wish to extend to all the Chapters a Very Happy and Prosperous New Year. We had a most Merry Christmas, as you all probably did, with a lus-

cious Old Fashioned Turkey Dinner in the Gold Room at the Fort Pitt Hotel on Friday, December 20, and good "Ole" Danny Nirella furnishing the quite appropriate music and a Floor Show Delux staged by Peg Lanagan, a theatrical agent well worth remembering, and Door Prizes that will be long remembered by the boys. Thanks to our worthy Entertainment Committee Chairman and his ideas.

But getting back to our last meeting of Friday December 6, which was again held at Stouffers in Pittsburgh, we had a most enjoyable meeting and quite instructive too. Mr. E. V. Crane of the E. W. Bliss Co. told of "Plastic Working of Metals by Power Pressing", and illus-

trated with both slides, charts and movies just what is taking place when we form metals.

Mr. Crane's talk started with the beginning of sheet metal forming, the rolling of steel sheet by hot rolling and progressive cold rolling with subsequent operations. His graphic charts showing the plastic cycle and microscopic sections of metal of the drawn pieces gave a clear understanding of this plastic working of metals. He also showed how a given metal may be worked in the hot stages until certain limits are reached and the metal cools, and how by subsequent reheating to take the hardness down, you could keep on working the metal to the final desired article.

He closed by giving examples and movies of practical work and equipment for performing punch press operations.

Buffalo

The Buffalo-Niagara Chapter held its dinner meeting at the University Club on November 28, 1940. Dinner was served at 7 p.m. Forty eight members and guests were present for dinner. There were fifty-two present for the meeting.

The meeting was called to order at 8 p.m. by Mr. Keller. He announced that the drive for new members was under way and hoped that each member would try and bring in at least one new member. The guests were then presented by Mr. Keller.

Mr. Crofoot outlined the programs for December and January meetings. He, also, announced the annual dinner dance would be held Feb. 15. Mr. Crofoot then introduced the speaker for the evening, Mr. W. B. Karp, United Secret Service, who spoke on "Know your money." Mr. Karp's talk was most interesting and was accompanied by sound pictures. This was an educational film as an aid to crime prevention and was very interesting.

Rockford

The Rockford Chapter held its regular monthly meeting on December 5 at the Hotel Faust. The meeting was the second annual joint meeting of the Rockford Navy Club and the A.S.T.E. The Navy Club had a fine collection of boat models on display. The A.S.T.E. had a display of educational exhibits. Hawaiian music was played while guests and members enjoyed eating a turkey dinner with all the trimmings. The dinner speaker was H. P. Warren, U. S. N., Chief Machinist's mate, who spoke on "Technical Training in the Navy." The Technical Speaker was Ernest Flanders of Jones & Lamson Co., Springfield, Vermont, who gave a very interesting talk on thread grinding, use of comparator, grinding wheels and their lubricants. Mr. Flanders answered many questions put to him by his audi-

(Continued on following page)

MILLING MACHINES

by the Yard!

Not quite, but when buying Gorton Super Speed Millers you buy only the speed ranges, feeds and other facilities needed. This means important savings to you.

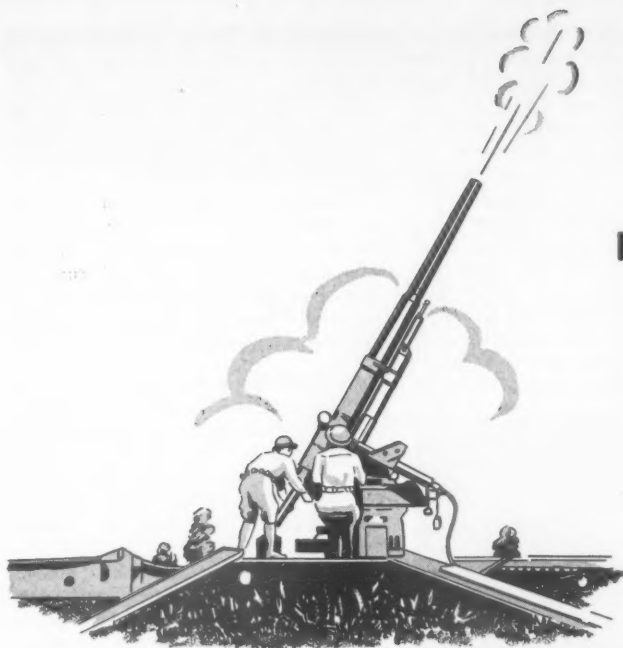
For instance, the standard Gorton Miller may be purchased with or without power spindle feed, power longitudinal and cross feeds, scales and verniers, dial indicators, coolant pump and other features.

For full information ask for Bulletin 1400-A.



GEORGE GORTON MACHINE CO.

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Your own
**FIRST LINE OF DEFENSE
 IS A RESPONSIBLE
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ECLIPSE COUNTERBORE COMPANY

D E T R O I T • M I C H I G A N



**FOR AMERICA'S DEFENSE WORK
 OR ANY OTHER WORK, UNIVERSAL COL-
 LET CHUCKS GRIP END-MILLS SECURELY**

Universal Collet Chucks use broken or whole straight shank tools. No tang required. Concentric to within .001. Adjusts within .002 depths. Grip as strong as solid steel. Write for complete facts and prices.



UNIVERSAL ENGINEERING CO.
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ARMSTRONG

**DROP
 FORGED
 "C"
 CLAMPS**



Because they never give, these **ARMSTRONG Heavy Duty "C" Clamps** are safe-

ly used, day after day, to carry these gigantic steel automobile body dies where the slightest spread or spring or the least slippage of the screw would result in disaster.

Here is dependable quality that you too can rely on. Look for the Arm-and-Hammer Trade Mark. It guarantees a better clamp. Write for Catalog C-39

ARMSTRONG BROS. TOOL CO.

"THE TOOL HOLDER PEOPLE"

340 N. FRANCISCO AVE. CHICAGO, U. S. A.
 Eastern Warehouse and Sales: 199 Lafayette St., New York

A. S. T. E. DOINGS

(Continued from preceding page)

ence. Some of the highlights of his talk were inspection of thread by the use of the comparator, grinding threads from solids, wheel dressing and an explanation of the fundamentals of Jones & Lamson's method of thread grinding.

Baltimore

The Baltimore Chapter held its dinner meeting at Sears Roebuck Auditorium, Wednesday evening, December 4, 1940. Dinner started promptly at 7 p.m. and was presided over by Chairman Mr. Lou,

who introduced one of the national officers E. W. Dickett, First Vice-President of the American Society of Tool Engineers. Dinner was attended by a large delegation of Washington, D. C. and a large number of members (60 members).

The technical session started promptly at 8:30. The meeting chairman introduced Mr. Dickett to the audience. Mr. Dickett spoke briefly about the growth of the American Society of Tool Engineers and impressed upon each officer and member the responsibilities the American Tool Engineers carry in order to carry through the Navy Armament Program.

The speaker for the evening, Mr. F. D.

Bowman, Adv. Manager of the Carborundum Co., was introduced and received a great ovation from the audience. Mr. Bowman spoke upon the subject of abrasives and its use is accepted as a matter of course, but back of this modern product of the electric furnace lies a story of development and application of an interest seldom met with in industrial arts. Mr. Bowman took us back 50 years ago when grinding wheels changed from tool sharpeners to a real production tool. A movie was shown pertaining to production uses of abrasives.

New York-New Jersey

The regular meeting of the Chapter at the Essex House in Newark, New Jersey, on December 10, 1940, was opened with a report on the anniversary dinner-dance held last month, which showed a gratifying financial success for the Chapter Treasury.

It was further reported that the membership drive is progressing exceedingly well, especially at the group within the Chapter.

The speaker of the evening was Mr. John Haydock who spoke on "The Modern Trend in Machine Tool Design." His talk, as well as the pictures shown, had special reference to the National Defense Program. Various operations on parts of the Garand Rifle were of particular interest to Tool Engineers.

Mr. Haydock also showed two high-speed motion pictures from the General Electric Company on "The Making of Chips" which revealed many secrets during cutting action by its slow motion reproduction.

The entertainment value of the meeting was further increased by a sound motion picture of the Ethyl Oil Company, titled, "The Story of Power and Speed."

Members and guests, therefore, had plenty to talk about, when, unexpectedly, beer and pretzels were offered.

The November meeting of the Philadelphia Chapter was held in the Ballroom of the Engineers Club with 160 members present. A fine turkey dinner was enjoyed by all.

The coffee speaker was Mr. Ralph H. McClaren, Associate Director in charge of aviation at The Franklin Institute, who gave a very interesting talk on the many and varied exhibits at the Institute.

After the business meeting Mr. Carl Betz, Chief Engineer of the Magnaflux Corporation, addressed the meeting on The Magnaflux Method for testing ferrous parts. Mr. Betz answered many questions asked by the members present and with the aid of a Magnaflux machine placed on the floor gave several demonstrations. Everyone found this subject very interesting.

A rising vote of thanks was given to Mr. Howard W. Gross, Dean of the Spring Garden Institute and chairman of

(Continued on following page)

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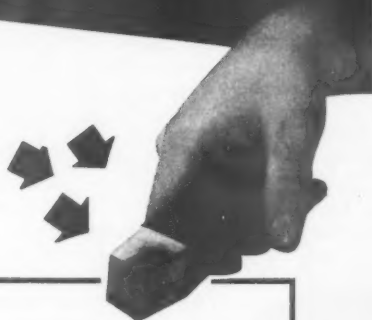
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A. S. T. E. DOINGS

(Continued from preceding page)

the chapter committee on publicity, for the splendid job he did on preparing and distributing the Year Book.

The Chapter was led in song by Mr. W. F. Ritz, secretary of the Globe Automatic Sprinkler Company.

Mr. J. A. Bessinger, Jr., a former member of the Pittsburgh Chapter and now transferred to Philadelphia, was present. Mr. Bessinger is Works Manager of the M. L. Bayard Company of Philadelphia.

We were very glad to welcome back among us William Battersby of the Logansport Company. Bill had been con-

fined to his home for ten weeks with a broken foot.

Chairman Paul Frankfurter announced the death of two chapter members since our last meeting; Mr. John Quantius, Tool Designer, with Peters Engineering Company of Philadelphia; and Mr. Henry Starkweather, Superintendent of Small Arms Department of Frankford Arsenal. Both men were active members of Chapter No. 15 since its formation. The meeting stood in silent prayer in tribute to the memory of these men.

A twenty pound turkey awarded as a door prize was won by Mr. Luther Johnson of the Lukens Steel Company of Coatesville, Penna.

Rochester

Even with the wide open spaces afforded auto drivers at the University of Rochester, the Rochester Chapter members had trouble finding parking spaces. Those attending the December 11 meeting heard a scholarly talk by Mr. Frank R. Palmer of the Carpenter Steel Company. Health and Personality, usually associated with Tool Engineers, seemed to play a very important part with tool steels also. Mr. Palmer associates steel specifications and the timbre characteristics to the health and personality factors in a very interesting manner. The design influence, the act of making the tool, the selection of steel and also the treatment were discussed. Whereas these four important operations often are thought of as units in addition, that is 10 plus 10, plus 10, plus 10 equal in a good finished tool valued at 40, Mr. Palmer pointed out that by so considering the tool a zero hardening treatment would still show a tool at a 30 value, were it admittedly of no value whatsoever. He pointed out that the true way to look at it is by multiplication and cited that by using the same 10 values multiplied four times you would get a result of ten thousand. By comparing the same failure in heat treatment whereas all other factors were satisfactory, for example, design 10 multiplied by 10 for tool making and again 10 for steel would equal 1000. However, the cumulated value of 1000 multiplied by the zero value hardness would give the zero result, which is the true value of the tool when a hardening failure has occurred.

With the aid of projector slides, Mr. Palmer showed another very interesting slant on tool steel selections. Orienting from a center position on a chart he employed the four directions, North, South, East and West, for areas in steel characteristic classifications. To the North, he showed the greater "wear area". To the South, he located "Toughness." In the West, "Greater Accuracy", and in the East, "Hardness". His diagram was made up of a number of diamond shaped areas all of which could be considered a specific type of tool steel. By so locating the types in respect to the compass, it appeared to be comparatively easy to select a steel with the characteristics desired by a Tool Engineer.

There is no question but that the well attended meeting was enjoyed by all those present, as a number of favorable comments were passed after the meeting.

Dayton

The Dayton Chapter held its dinner meeting on November 11 at the Hotel Gibbons. There were 43 members and guests present.

Mr. Pook introduced Mr. Louis Tschudi who spoke briefly and humor-

(Continued on following page)

In Tune with the Defense Program

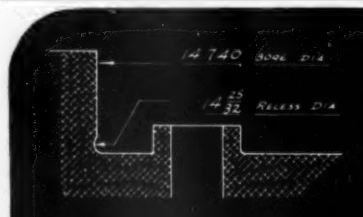
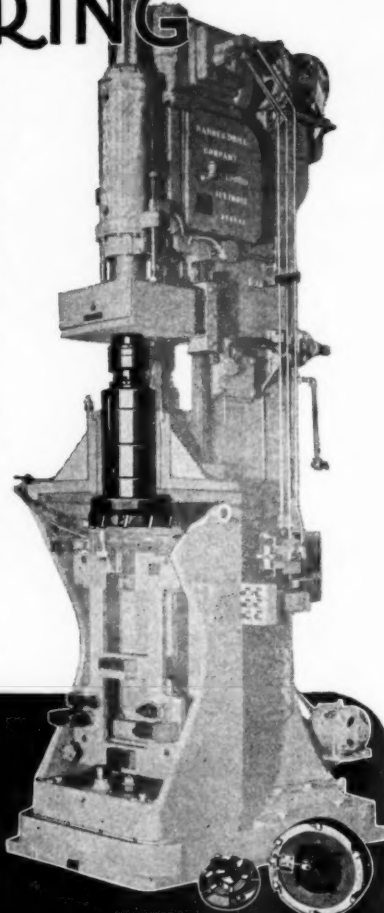
GAIRING

Illustration at the right shows a Gairing Cutter Head boring a 14.740" diameter hole and under-cutting a 14-25/32" recess in the end of the crank case of an airplane motor. Rough and finishing tools are interchangeably mounted on the long anti-friction boring tool holder which slides up and down but does not revolve in the bronze bushing. Center shaft of the tool driver revolves in precision anti-friction bearings while the outer sleeve is prevented from rotating. Note particularly the sturdy construction of the cutter head and tool holder assembly which weighs slightly more than 500 pounds.

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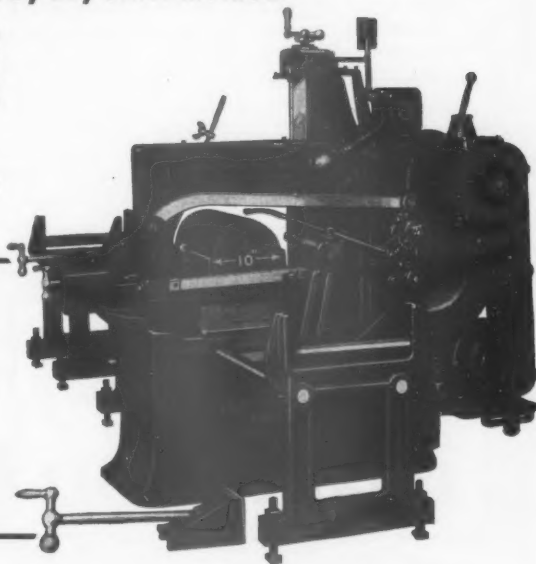
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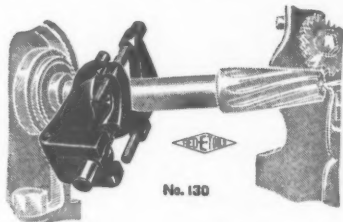
Full ball-bearing construction throughout. Combination positive-and-friction feed. Depth gauge will raise blade at any desired depth of cut, (for notching or slotting). Blade always horizontal, cuts on draw stroke, raises out of cut on fast return. Rigid saw frame is reciprocated by crank lever or shaper link action (33 1/3% faster than ordinary crank action).

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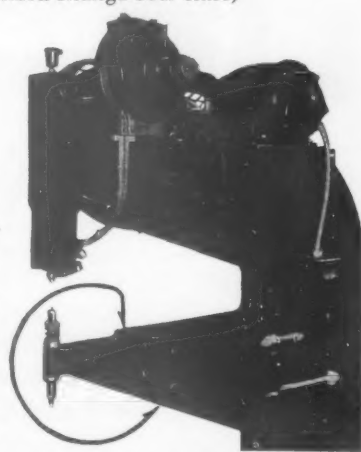
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A. S. T. E. DOINGS

(Continued from preceding page)

ously on some of his experiences as a tool designer and as a football coach.

Mr. Goodwin thanked Mr. Tschudi for his presentation and then introduced Mr. G. H. Sanborn of the Fellows Gear Shaper Company.

Mr. Sanborn presented a talk, "New Developments in Involute Gearing," which was illustrated by slides. He also provided an interesting exhibit of unusual gears. The talk was followed by a question-answer period.

Syracuse

On Tuesday, December 10, the Syracuse Chapter met in the Syracuse Industrial Club to hear, as Speaker of the evening, Mr. Frank Palmer, Assistant to the President of the Carpenter Steel Company. Mr. Palmer spoke on the subject, "Tool Steels", emphasizing recent findings in the realm of heat treatment. The lecture was both instructive and very interesting, to each of the 65 present.

Preceding the lecture, thirty-one members and friends attended the regular informal dinner at 6:30 p.m. in response to a drive promoted by the executive committee. This drive more than doubled the number present over the preceding

month, and we have hopes of further increasing the attendance at these dinners.

During the business meeting, the report of Mr. Joseph Owens was read regarding the annual dinner dance to be held at Drumline on February 14. This dinner dance has always in the past proven to be a grand success, and the prospects for the coming frolic are optimistic. Everyone has great faith in Joe's ability to afford a good time to all present.

Schenectady

At the regular monthly meeting held Monday evening, December 9th members of Chapter 20—A.S.T.E. heard a very interesting talk on the subject of "Tool Steels" given by Mr. Frank Palmer, Assistant to the President, of the Carpenter Steel Company.

In opening his discussion, Mr. Palmer gave a human touch to his subject by likening the selection of a tool steel to the selection of an employee, contrasting the desirable qualifications of each which must be given careful consideration before a final choice is made.

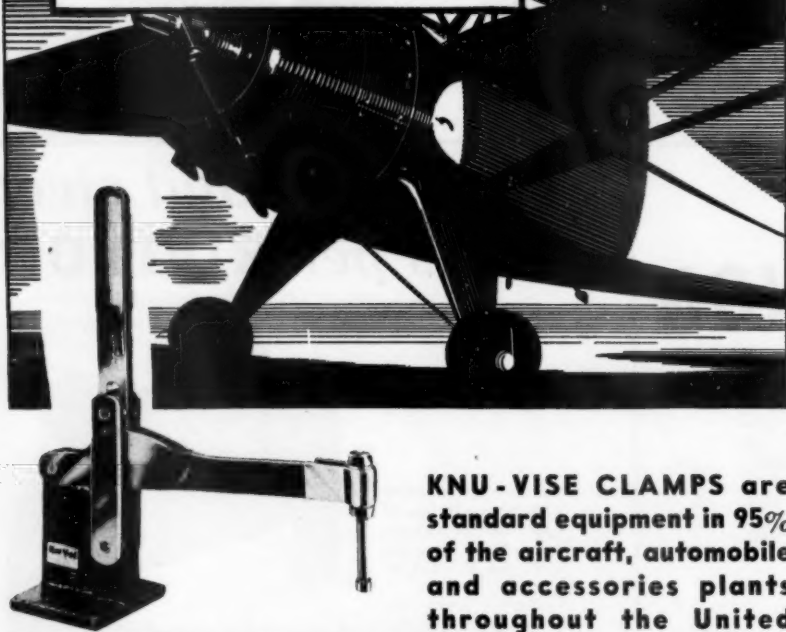
After demonstrating by use of slides the desirable characteristics and physical properties of tool steels, Mr. Palmer pointed out the four following factors as essential to good tools—"Design—Tool-making—Steel Selection—Heat Treatment." He emphasized the fact that a failure of any one of these elements will result in an unsatisfactory tool and estimated that the performance of the average tool in the average shop could be doubled in effectiveness if full consideration was given to each of these factors.

"The first two factors of the formula—Design and Toolmaking—are usually well thought out by the customer", stated Mr. Palmer, "but the manufacturer of tool steels can provide a valuable service by giving advice on the last two—Selection and Hardening". He then discussed a practical plan which his company has developed for use as a guide to the selection of tool steels and concluded his talk with a very interesting treatment of the technique of hardening. This information in the hands of those responsible for the construction of tools would obviously result in a marked improvement of tool performance and a consequent reduction in maintenance costs. The meeting was in charge of Vice Chairman, Al Schuneman, who conducted a short business session before Mr. Palmer's talk during which he read Mr. Lamb's letter outlining preliminary plans for the Machine and Tool Progress Exhibition to be held in March. Fred Law, Chairman of Programs, announced that Mr. E. V. Crane of the E. W. Bliss Co. would address the Society at the January meeting to be held Monday evening, January 13, on the subject of "Punches & Dies."

(Continued on following page)

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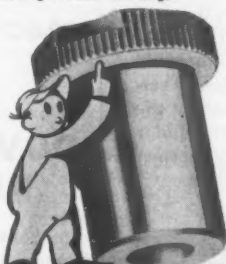
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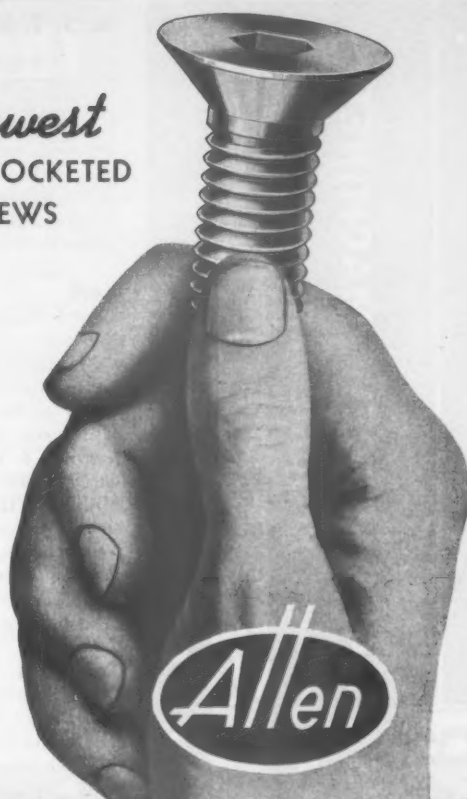
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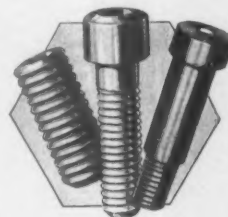


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A. S. T. E. DOINGS

(Continued from preceding page)

Among the guests present at the meeting were members of the American Society of Metals and students currently enrolled in the National Defense Training Program being conducted by the Rensselaer Polytechnic Institute at Troy, N. Y.

York

York Chapter had a grand meeting in December and continued to show enthusiasm by having forty-five friends and members attending the dinner and about eighty at the technical session. Francis J. Trecker, Assistant Chief Engineer of Kearney & Trecker, talked to the boys on "Modern Methods of Tool and Die Milling." His talk was illustrated by sound movies and lantern slides. There was no doubt in anyone's mind about this meeting being tops. As a pep-builder, dinner music was furnished which seemed to instill new life into the meeting.

Tri-Cities

Tri-Cities Chapter held its second Annual Dinner Meeting at the LeClaire Hotel, Moline, Illinois, on December 4, 1940, to which wives of members were also invited. Members and their wives attending numbered one hundred thirty.

Entertainment for the evening was provided by "Professor" Russell E. Oakes, the "Wizard of Waukesha" and his goofy inventions. His subject was "Impractical Suggestions for Tool Designers", which he illustrated with several gadgets of his invention. The climax of the show was his hydraulic cigarette lighter weighing about fifteen pounds and requiring a suitcase in which to carry it.

The committee in charge of this meeting arranged for organ music during the dinner hour and flowers for the ladies.

Elmira

The Elmira Chapter held its dinner meeting at the Langwell Hotel, Elmira, on November 14. The members and guests, which were 55, assembled at 6:30 in the Blue Room for dinner.

After the business meeting, Chairman J. Raymond Blank introduced Mr. Erik Oberg whose topic "The Machine Before the Court of Public Opinion" was most interesting and cleverly delivered.

After the lecture, the Chairman announced the open meeting for the discussion of any topic along Tool Engineering lines. Mr. John R. Lynch brought up a question about gauges. This question was discussed for about forty-five minutes.

Worcester

In keeping with the interest everywhere manifest in the rearmament program the Worcester Chapter arranged an Army

(Continued on following page)

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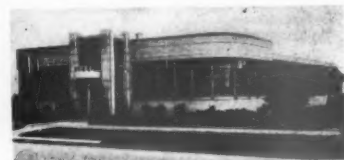
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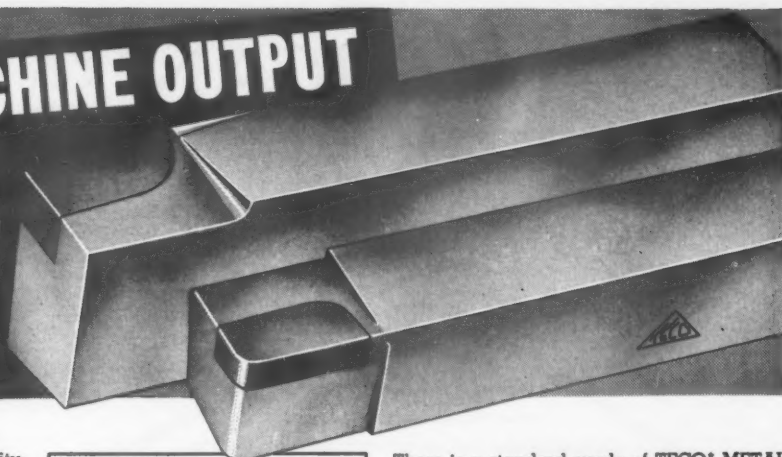


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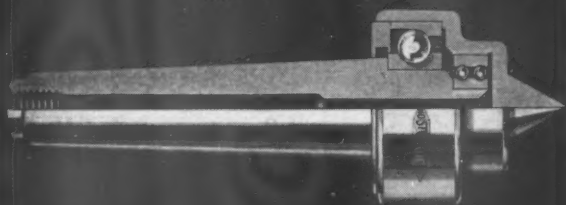
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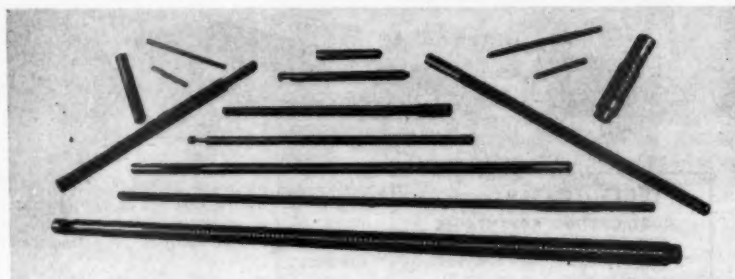


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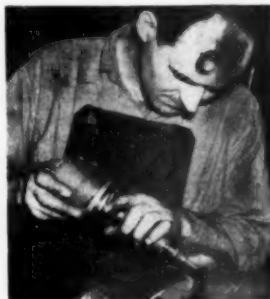
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A. S. T. E. DOINGS

(Continued from preceding page)

and Navy night program for its December meeting on Monday, the 9th, at Putnam & Thurston's restaurant. We were very fortunate in securing as our main speaker Lt. Col. Clark S. Robinson of the United States Army Ordnance Reserve. He chose for his subject "The Relation of the Ordnance Department to National Defense." He gave the boys a very good idea of what the Ordnance Dept. is up against in securing supplies for the Army.

Guests of the evening were His Honor William Bennett, Mayor of Worcester; Congressman Pehr G. Holmes; Adj't Gen. Edgar C. Erickson; Lt. Col. J. S. Crawford, Ex. Officer U. S. A. Ord. Dept.; Lt. Commander Andrew B. Holstrom, ret'd.; Major Gen. Thomas F. Fole, ret'd.; Col. J. H. Pelot; and Lt. Victor E. Hillman, U. S. N. R.

Ontario

The November meeting was held in the Oak Room, Union Station, Toronto, and about seventy-two attended the dinner, and about fifteen came after dinner. After the toast to the King and the Toast to our American friends, Mr. Ford Lamb, Executive Secretary from Detroit spoke. He advised that the next semi-annual meeting would be held in October 1941 in Toronto. He also spoke on the educational program of the A.S.T.E. and the plans for the enlargement of this program.

Following the business meeting Mr. Drummond of the National Broach Company of Detroit gave a very interesting talk on "Modern Methods of Gear Finishing."

Los Angeles

Los Angeles Tool Engineers turned out for their monthly meeting November 14 in such force that the walls of their private dining room at Scully's Cafe were literally pushed out to make room for an unprecedentedly large gathering. Considerable time was consumed in introducing the many guests, after which Chairman Louis Biehler made his report on the semi-annual meeting in Cincinnati. Adjournment was followed by a plant visit to the U. S. Electrical Motors, Inc., plant.

The courtesy extended by this organization to the Tool Engineers deserves particular mention. The night shift was especially augmented so that complete operation of the plant could be studied. The visitors were taken through in groups of ten or twelve by plant executives who explained the technical phases of manufacture.

From rough storage to assembly the progress of material through the plant was observed from the heat-treatment of

(Continued on following page)

THE TOOL ENGINEER



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CATALOG M.A.

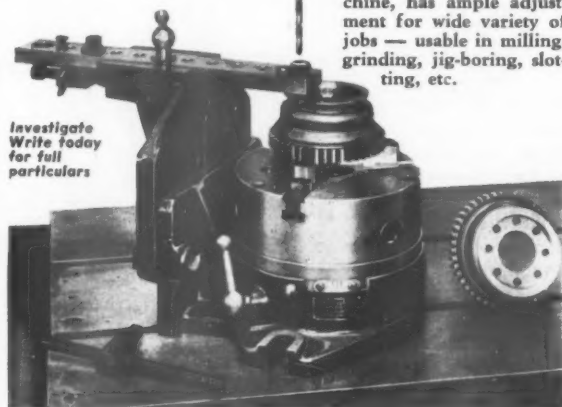
FRAY MACHINE TOOL CO.
GLENDALE, CALIF.

NEW—a spacing device for Drilling

Eliminate errors, speed production, lower costs with the Hartford SUPER-SPACER — a superior spacing device for the rigid control of accurate machining operations.



The illustration here shows the Hartford SUPER-SPACER used for drilling. It will swing work up to 11" in dia.—holes up to $\frac{3}{4}$ " can be drilled. Can be quickly secured to base of machine, has ample adjustment for wide variety of jobs — usable in milling, grinding, jig-boring, slotting, etc.



Investigate
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Dependability in Pumps

In these days
of speeded production

there must be no lost motion—no gambling with equipment that is not reliable at ALL times.

PIONEER PUMPS ARE DEPENDABLE

The impeller, designed to the most advanced hydraulic principles, assures highest efficiency, particularly where maximum heads are essential, or in supplying batteries of machines from a central coolant reservoir.

Greater pressures are provided and lower power consumption is achieved. Maintenance cost is low.

The illustration above shows the "VB" Model, which mounts directly on the side of machine base or coolant reservoir, making for a close-coupled self-contained installation.

Eliminates unsightly piping. Motor and pump are easily accessible.

Let us put your name on our mailing list
to receive the Pump Engineering Manual.
IT IS FREE.

**PIONEER ENGINEERING
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T. H. L. FRONT LEVER BENCH PUNCH



PRICE WITH ONE
PUNCH AND ONE
DIE—

\$37.00

Immediate
Shipment

Built for hard, tough work—die cannot lose alignment with punch—all parts interchangeable.

Capacity $\frac{1}{2}$ " holes through $\frac{1}{8}$ " steel; $\frac{3}{8}$ " through $\frac{1}{4}$ " steel. Can also be made for holes up to $\frac{1}{8}$ " in thinner metal. Stock punches and dies available from $\frac{1}{8}$ " to $\frac{1}{2}$ " by 64ths.

Weight, 70 lbs.

**T. H. LEWTHWAITE
MACHINE CO.**

(Est. 1890)

307 E. 47 St.

NEW YORK

A. S. T. E. DOINGS

(Continued from preceding page)

castings in three eight-hour stages of pre-heating, soaking and cooling to the final inspection of the finished motors. Pressure and centrifugal casting of rotors integral with fan, aroused particular interest. Punch presses with vacuum pick-up of blanks, shaft turning with Keller Magnetic control, stator dynamic balancing and up-to-date inspection equipment all gave evidence of high grade manufacturing. With every facility available for the study of features particularly interesting to the individual, an exceptionally profitable evening was had.

Golden Gate

The regular monthly meeting was held on November 12 and consisted of a combined inspection tour, dinner and technical session. The inspection trip was of the Boeing School of Aeronautics, and about eighty people attended the inspection trip of a United Air Lines "Mainliner" air plane at 5:30 p.m. at the Oakland Airport.

Dinner was held at 6:45 at the Coit Hotel in Oakland and was attended by approximately seventy-five members and the meeting following the dinner was attended by approximately eighty men.

Mr. Harold B. Thayer of the Boeing School of Aeronautics was introduced by Mr. Horack and showed first a movie of "United Air Lines Coast to Coast." Mr. Thayer made remarks during the showing of this movie.

A second movie, "The Design and Construction of an Airplane" was then shown and during which Mr. Thayer also made remarks. Following these movies, Mr. Thayer spoke on "General Comments on Airplane Construction", which was followed by a very lively discussion concerning Commercial as well as Army and Navy airplanes.

South Bend

The December meeting of the South Bend Chapter of the American Society of Tool Engineers was held in the Rotary Room of the Oliver Hotel, South Bend, on December 12th. Mr. Lester St. Clair, Vice Chairman occupied the chair in the absence of Mr. E. Barber, who will be away from the city for several months.

Mr. George E. Brumbach, metallurgist of the Carpenter Steel Co., Reading, Pa., spoke on "Tool Steel Applications".

Mr. Horace Wentzell, Membership Chairman, reported eight new applications for the local chapter. There were sixty-five present for the dinner, and one hundred and five for the technical session.

(Continued on following page)



PRODUCTION LINE METHODS Applied to SCREW MACHINE REBUILDING

Modern Collet's new plant addition was designed to handle rebuilding and modernizing of screw machines. Every square foot of floor space is utilized to provide the finest facilities for this type of work.

What was an unusual—and often experimental—service only a few years ago has now been replaced by efficient and highly specialized methods of volume production. The complete story on the types of machines which Modern Collet is now rebuilding and modernizing.... the work which is being done.... and the length of time necessary before delivery can be made.... is yours for the asking.

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SUNNEN Precision HONING MACHINE

● For accurately sizing and finishing internal cylindrical surfaces following any previous machining operation. Size range: .185" to 2.400" diameters and up to 7" in length. Guaranteed accuracy—super smooth finish.

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U S HEADS STANDARD SINCE 1915



30 DIFFERENT STANDARD SIZE
ADJUSTABLE DRILL HEADS,
CAPACITIES UP TO $1\frac{1}{2}$ " DRILLS

SEND US YOUR B/P'S

All Types of Fixed Center Heads

UNITED STATES DRILL HEAD CO.
Cincinnati, Ohio



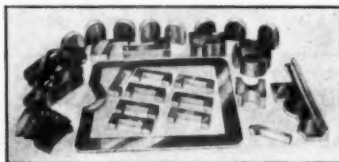
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Yourself
Any
Length

DoAll BAND SAWS

Now in Special Metal Boxes

Just what band saw users have been asking for—a modern, compact, convenient way to stock saws. Safe to handle, easy to get at. Window shows how much saw remains in box. DoAll Saws last twice as long because of their high tensile strength. Originally developed for the DoAll Contour Machine, but most of the widths are also adaptable to metal cutting band saws.

FOR REALLY TOUGH JOBS



A group of special parts made at Ingersoll Milling Machine Co., Rockford, Ill. Tool steel was cut at the rate of $1\frac{1}{2}$ square inches, cast iron $3\frac{1}{2}$ square inches per minute. This is typical of the kind of work DoAll Saws do faster and better on all metals, including cold rolled nickel, ductile aluminum alloy, laminated low carbon steel sheets, neoprene, etc.



Vanadium alloy steel part cut at American Brass Co., Detroit, Mich. in $3\frac{1}{2}$ hours. Diam. 7", cutting height 5". This job would take $3\frac{1}{2}$ days on a shaper.

Send your difficult metal cutting job to our Testing Laboratory for experiment.

FREE TEST

Send for booklet **ACTUAL PERFORMANCE RECORDS OF DOALL SAWS.**



THE DOALL COMPANY, INC.

1211 Thacker St. Des Plaines, Ill.

Send free booklet on DoAll Saw Performance.

Name.....

Address.....

A. S. T. E. DOINGS

(Continued from preceding page)

Springfield

On December 16 the Springfield Chapter held its "bang-up" meeting and wound up by making front-page headlines in both local papers as well as an Associated Press story throughout the country. The occasion was Springfield Chapter Executives' Night, and seated at the head table were executives from the leading Springfield industrial concerns as well as Colonel Frederick H. Payne, Chief of the Hartford Ordnance District of the War Department, Colonel E. Ayer of the Hartford Ordnance District, and the Springfield Mayor, Roger Putnam.

Mr. Frank Curtis did an excellent job as master of ceremonies as presiding officer. Short addresses were made by Mayor Roger Putnam, James Y. Scott, President, Van Norman Machine Tool Company, Dr. E. C. Gilbert, Colonel F. H. Payne, and Mr. A. H. d'Arcambal.

The speaker of the evening, John H. Van Deventer, was then introduced, who gave an excellent talk on "Tools for National Defense". This was a very timely topic and was well delivered and well received. The Springfield Chapter is to be congratulated on the attendance of this meeting considering the fact that the weather man was very unkind that evening. It is a tribute to the speaker and the kind of meetings being put on by this Chapter that 191 members and guests sat down to dinner and approximately 250 attended the meeting.

Boston

The December 12th meeting of the Boston Chapter was a splendid success with 131 being present at dinner and 176 attending the technical session.

Chairman Forbes called on Mr. A. H. d'Arcambal, National President, who spoke for a few minutes on the rapid growth of the Tool Engineers and the service our Society is giving Tool Engineers.

Mr. R. B. Wade, Chairman of the Program Committee introduced Mr. Chandler Gardiner of Johnson Automatics, Inc., who gave us a most interesting demonstration of the ease of dismantling and assembling the Johnson Automatic Rifle and told us considerable about its manufacture. Mr. L. L. Whitney of Johnson Automatics, Inc., then showed moving pictures of the gun in action with Captain Johnson using the rifle in various positions.

Guest speaker, Mr. Ralph Flanders, President of the Jones & Lamson Machine Company was then introduced by Mr. Wade and presented an interesting talk on Tool Engineers. He told how inter-

(Continued on following page)

BALDOR

BALL BEARING GRINDERS

for accurately sharpening

CARBIDE TOOLS



1-YEAR GUARANTEE

BALDOR CARBIDE TOOL GRINDER is precision-built for accurately and quickly sharpening Carbide Tools. Sturdy $\frac{1}{2}$ H.P. heavy duty, ball-bearing, reversible Motor. Large adjustable tool-rest lobes. Satisfaction guaranteed. Price, complete with wheels and accessories.

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DOUBLE FLOATING BOX TYPE HOLDER



Patent Applied For

This holder is designed for faster and more efficient serial marking on hot or cold, flat, round, or angular surfaces. It is constructed with a sleeve which levels or holds the "floating" type holder at right angles on the object being marked. The steel type also "floats" within the type holder. Because both the holder and type are held loosely in place, a double-leveling action takes place when the holder is struck with a hammer. Type holder is of Safety Steel construction to eliminate spalling and mushrooming.

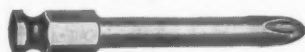
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APEX PRODUCTION TOOLS

Aircraft . . . Automotive . . . Manufacturing



Apex-Phillips Power Bits, for all electric, air and spiral drivers, are made from special shock-resisting steel, heat-treated and tempered to give maximum hardness, toughness and wear resistance.

Apex Power Bits for Slotted Head screws, for all electric, air and spiral drivers, range in size from No. 4 to No. 18 screws.

Apex Universal Joints have no projecting ears, screws or sharp corners to catch; can't overtravel their working angle of 35° and lock; are durable and smooth running.

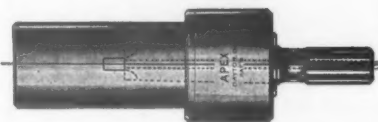
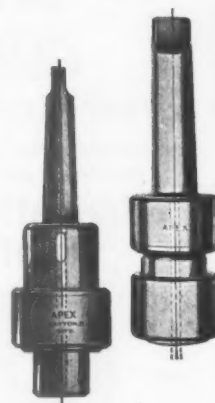
Apex Universal Socket Wrenches are available for all kinds of speed braces and extension shanks.

Apex Safety Friction Chucks maintain their friction setting... are not affected by end thrust...

can be used in any position... tools can be changed while machine is running... chuck slips before breaking tool—these features save time and money.

Apex Floating Tool Holders make possible accurately reamed and tapped holes on any type equipment... amount of float varies from a few thousandths to 1/8" with Quick Change Drill collet, tools for series of operations can be changed without slowing down the machine... available in Extended Socket and Short Nose types for Morse Taper or straight shank tools.

Apex Vertical Float Tapping Chucks are used for multiple tapping. Vertical float permits each tap to enter free and tap its hole true to size. Used for power feed, lead screw or hand feed tapping. Same collets and tools as Friction Chucks.



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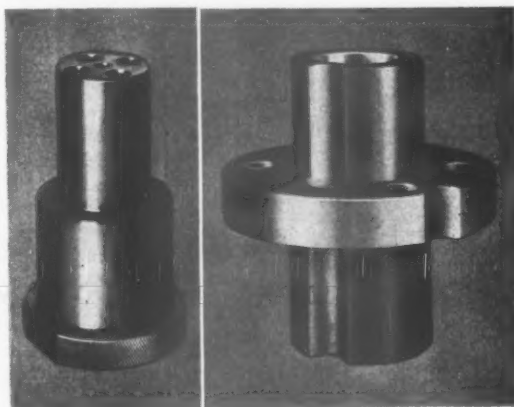
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MORE SPEED LONGER LIFE with PUTNAM END MILLS

In an operation such as that illustrated—milling 3/8" slots in a die block—Putnam End Mills permit the maximum speed and feed. In addition, manufacturing and heat treating methods assure long, trouble-free service. Why not prove to your own satisfaction—by actual use on your machines—that the end mills which do "cut faster and last longer" are produced by Putnam?

PUTNAM TOOL COMPANY

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Standard Bushings are kept in stock, but—
**WE CAN MAKE THEM
FANCY, TOO!**

Acme facilities for the manufacture of drill jig bushings are available to make other hardened and ground parts to order.

Just send us your prints.



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LESS OPERATIONS AND FAR BETTER WORK WITH A

GATCO

ROTARY PILOT BUSHING

Pilot and bushing fits with a **PUSH** fit,
therefore a perfect bore

ROUND-CHATTERLESS- SMOOTH

DUST-
PROOF



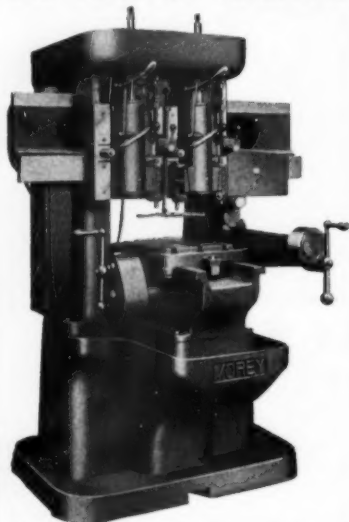
AS A
WATCH

GATCO Rotary jig and pilot bushing is built for core drilling, diamond boring, turret tool piloting, piloting hollow mills, line reaming, carbide boring, spot facing, etc.

Write for full information and prices

GIERN & ANHOLTT TOOL COMPANY
1312 Mt. Elliott Avenue, Detroit, Michigan

MOREY No. 12M High Speed Vertical PROFILER and MILLING MACHINE



Many new features speed up manufacture of small parts—Increase accuracy. Unique table design gives twelve inch maximum working space.

INVESTIGATE!

Write for Bulletin 12M

MOREY MACHINERY CO., Inc.
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A. S. T. E. DOINGS

(Continued from preceding page)

changeable manufacture was started as a result of the manufacture of guns and of the part played in interchangeable manufacture by Tool Engineers in the State of Vermont. He explained that around 1900 the first No Go Gage came into use and how limit gages in the past ten years have resulted in improvements in both design and manufacture of all types of mechanisms. Mr. Flanders also stated that Tool Engineers today had as their function the improvement of the method of manufacture in order to speed production without impairing the operation of the product.

Binghamton

The Binghamton Chapter held its regular meeting Thursday, November 14, 1940. The meeting opened at 8:00 P.M. by Chapter Chairman Wm. T. Forde who made current announcements relating to potential changes in meeting dates.

Suggestions for topics to be discussed at the forthcoming open meeting in December were requested and Mr. J. P. Ahern requested "Thread Grinding". This, however, was tabled because Vice-Chairman Kishbaugh announced that this subject was to be featured as a regular technical session in the near future. Other suggestions were made and Chairman Forde said that the Executive Committee would arrange a program of interest to all.

Mr. Forde then introduced the speaker of the evening namely—Mr. Ellis of the Heald Machine Company of Worcester, Mass. Mr. Ellis delivered a very forceful and interesting discussion on "Diamond Boring and Borematic Operations" illustrated by slides showing the various operations and applications as they relate to Heald products.

Mr. Ellis was well received and provided a very interesting display of sample parts produced on his equipment.

Western Michigan

The second meeting of Chapter 38 was held Monday, December 9, in the Browning Hotel in Grand Rapids. The meeting was attended by 70 members and guests. Mr. Cloud, Program Chairman, acted as toastmaster. Mr. V. R. Parker of the Brooklyn Division of Bliss & Company gave a lecture on "High Speed Automatic and Hydro-Dynamic Presses" using still slides and three reels of movies to illustrate his talk. Mr. B. Roberts of the Revere Copper and Brass Company, gave a talk on the uses of the different types of "Copper and Brass." After a round table discussion on the above subjects, and future activities of the chapter, the meeting adjourned.

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USED MACHINE TOOLS and POWER PRESSES

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These are on hand in our Warehouse for Your Inspection.

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THE TOOL ENGINEER

Swartz Tool Products Co.

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*wishes to announce the removal of
their offices and factory from
5259 Western Ave.*

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13330 Foley Avenue

*1 Block South of Fullerton, 1 Block East
of Schaefer Hwy.*

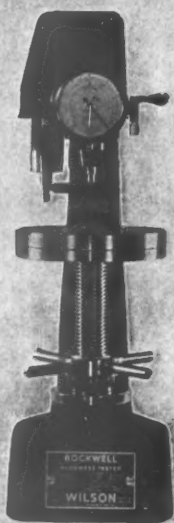
New Phone No.

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Effective

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"ROCKWELL" HARDNESS TESTER



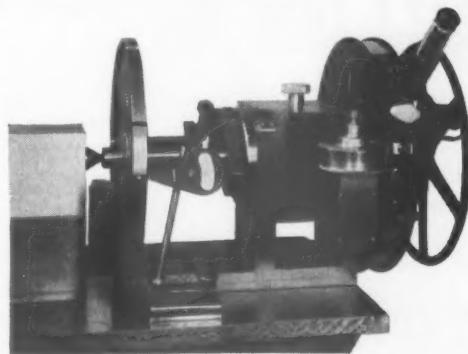
Acknowledged Accuracy

WILSON

MECHANICAL INSTRUMENT CO. INC.

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ANNOUNCING — VINCO OPTICAL INSPECTION MASTER DIVIDING HEAD

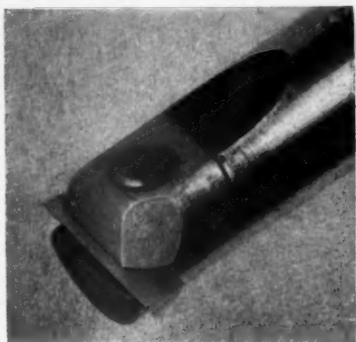


The latest addition to the Vinco line of precision tools and instruments is the OPTICAL INSPECTION MASTER DIVIDING HEAD. Unique and plain in design, very simple in operation, and absolutely dependable. Guaranteed to check within plus or minus 10 second accumulative error, on a complete circle; will repeat to within one second. An instrument of necessity for every well-equipped Inspection Room. Complete information given upon request.

Manufacturers of a complete line of precision gages for every application, master gears, index plates, gear checking equipment, profile wheel dressing fixtures.

VINCO CORPORATION

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The new EVEREDE BORING BAR is the only bar on the market having the economical triangular bit. The design of this boring bar permits the use of a larger diameter than formerly used, due to having the bit cut in front, making room for the bar. This design spells rigidity, making higher boring speeds and heavier cuts possible.

The EVEREDE BORING BARS are made of the finest heat treated nickel steel; and each bar comes equipped with six high speed steel triangular bits. In addition, this is the only boring bar that allows the use of a solid Stellite or carbide tool bit. This is accomplished by clamping the bit on the "V" type grip, which holds it firmly without danger of breakage. Send for descriptive folder.

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Willis Stutson
184 N. WACKER DRIVE, CHICAGO
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DANLY KWIK- KLAMPS

TOGGLE CLAMPS
FOR
Quick Positive
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In Any Position

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Chicago, Ill.; Milwaukee, Wis.,
513 E. Buffalo St.; Long Island City, N. Y., 36-12
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DANLY PRECISION
DIE SETS & DIE
MAKERS' SUPPLIES

THE Passing Parade

Gaylord G. Thompson, formerly supervisor of the application and control of carbide tools at the Gisholt Machine Co. has just been appointed Tool Engineer for the McKenna Metals Company, La-



Tool Engineer Thompson
From Gisholt to McKenna

trobe, Pa. He will engineer the installation and use of Kennametal hard carbide tools and will be located in Rockford, Ill.

Gilbert L. Wolfe has been appointed representative of the American Nickeloid Company, Peru, Ill., to have charge of their Schenectady office.

Howard L. Tibbetts, engineer at Crompton & Knowles Loom Works Worcester, for the past 16 years, has begun work at the Pratt & Whitney Aircraft Plant as a Tool Production Engineer.

Kurt R. Vogel, since 1916 associated with the Fisk Rubber Company and subsequently with the United States Rubber Company, has been elected Secretary of the Crucible Steel Company of America.

Colonel Frederick H. Payne, chief of the Hartford Ordnance District, will have as his two assistant district chiefs, former Governor Joseph B. Ely of Massachusetts and Philip B. Stanley, New Britain industrialist. They will serve at an annual salary of \$1 each. Mr. Stanley has been Vice President of the Stanley Works in New Britain.

A. R. Engler will be in charge of a new Southwestern District handling sales and service for Kearney & Trecker milling machines and Gisholt lathes and balancing machines. He will be located in Houston.

H. A. Scallen has been appointed District Manager for the Hartford branch of the Jessop Steel Company.

Harlan M. Ellis is now sales manager and Robert W. Russell is special assistant to the general manager for the Hamilton Standard Propeller Division of the United Aircraft Corporation.

(Continued on following page)

END MILLS

Can be completely reconditioned, from new centers and end teeth to tangs.

Either single or double end, any spiral.

Finished as large as they will clean up, or brought to specified sizes, standard or special. Ball or radius ends.

Prices are based on the size of the finished tool as shipped to you and will save you half or better.

NATIONAL TOOL SALVAGE CO.
3816 Beaubien St.
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RUTHMAN GUSHER COOLANT PUMPS

CUP DISC FAN PROTECTS MOTOR

A patented cup disc fan built into the upper part of the motor prevents oil or dirt from getting on the motor windings — just another reason why you can expect long and efficient service from Ruthman Gusher Coolant Pumps.



Model
No. 11020A



Model No. 11022
Patented and
Patents Pending

Gushers can be throttled to any speed without building up pressure, and they can handle cutting fluids containing grit without danger of injury. Write for complete data sheets.

THE RUTHMAN MACHINERY CO.
542 E. FRONT ST., CINCINNATI, OHIO
LARGEST EXCLUSIVE BUILDERS OF COOLANT PUMPS

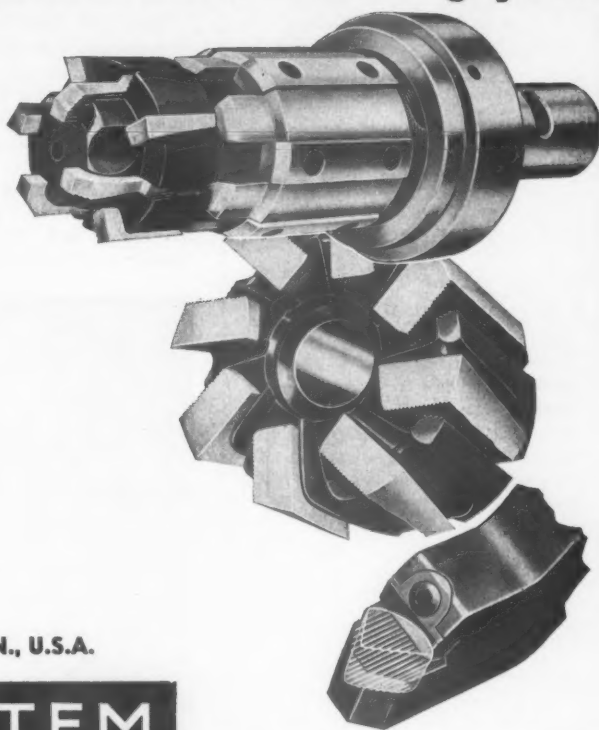
Why not do a COMPLETE modernizing job?

DON'T expect even the most modern metal working machines to hold today's pace if handicapped by old-fashioned solid milling cutters and single-point tools. Modernize COMPLETELY by tooling up your machines with the improved O K Inserted-Blade Cutters shown here. Refuse to sacrifice badly needed production to unbalanced equipment!

The O K System provides a high degree of flexibility. Accuracy is maintained down to the last grind by being able to quickly advance the blades in line of wear. Time is saved by having the right blade for routine and special jobs always in reserve. Economy is promoted by having only the cutting edges of high speed steel.

An O K engineer will gladly help you with your metal working problems.

THE O K TOOL COMPANY, SHELTON, CONN., U.S.A.



INSERTED-BLADE METAL CUTTING **TOOL SYSTEM**

Drive Taps and Reamers

WITH THE

ZIEGLER

ROLLER DRIVE

Floating Holder

"It Always Floats"

Furnished with male or female taper, straight, threaded or special shanks to fit any machine used for tapping or reaming.

Compensates for spindle misalignment, eliminating oversized or bell-mouthed holes.

Holders sent subject to your approval before acceptance.

W. M. ZIEGLER TOOL CO.
1920 Twelfth Street DETROIT

FLOATS
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Just ONE set-up for every weld

Save valuable time in welding, handling; do better "down-hand" welding—all with more safety, by using a C-F Positioner. Cut down crane service on large unwieldy work by "setting-up" just once for all welds. C-F Positioners are made in hand and power operated models with a variety of control features suitable for all kinds of work. Send coupon today for complete information about these remarkable welding machines which give every advantage to today's production demands.



CULLEN-FRIESTEDT CO.
Gentlemen: Please send circular No. W-P20:

Name.....

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Circular No. W-P20 describes C-F Positioners from 1,200 to 14,000 lb. capacity.



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We are saving from 25 to 40% on the manufacturing time for some of our accounts on National Defense Programs—let us plan your production to the best advantage of your tools as well as handling the designing of them—Ask us for particulars.

LASALLE DESIGNING CO.
838 W. LAKE ST.
CHICAGO, ILL.

PASSING PARADE

(Continued from preceding page)

Edward D. Dunning of New York and Philadelphia has been appointed assistant general manager of the Indian Motorcycle Company. For the past several years he has been in charge of engineering production for the Kulair Corporation.

Died

J. Wallace Carrel, at the age of 74, Vice President and general manager of the Lodge and Shipley Machine Tool Company, after a five month illness.



Manager Carrel
Started as a stenographer.

Starting work as a stenographer in a machine tool firm in Cincinnati, he rose to salesman, then branch manager of stores in New York and later in Cleveland.

While traveling in Europe for an American trade paper he encountered William Lodge, was made general sales manager of the Lodge and Shipley Company. He became Vice President and general manager upon Mr. Lodge's death in 1917.

Mrs. Susan L. Gammons, President and treasurer of the Gammons-Holman Company, Dec. 12, after a brief illness. Widely known in the machine tool industry, Mrs. Gammons succeeded her husband as president of the firm when he died in 1932.

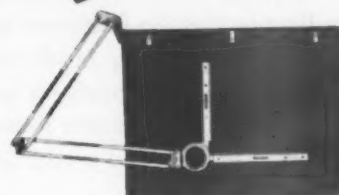
Harry Stoney, Chief Engineer of the Gillette Safety Razor Company, and Chairman of the Boston Chapter's Industrial Relations Committee.

Bruce W. Deacon, for eleven years Detroit Manager for D. A. Stuart Oil Company, on Dec. 9, at the age of fifty-seven. He was one of the oldest industrial oil salesmen in Detroit and had a wide circle of friends.

Thomas H. Boeshaar, 55, for twelve years general manager of the Ames Sword Company, on Dec. 5.

Bradford A. Durfee, 43, superintendent of commercial refrigeration and air conditioning at the Westinghouse plant in East Springfield, Mass., on Dec. 15.

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DRAFTING ROOM
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Wherever a new or changed design is required, accurate drawings of ideas can be made on the spot with a Drafto Portable Drawing Machine. Drafto operates smoothly and easily, and can be carried and used wherever you go.

Drafto retains every essential feature of a large, permanently located drafting machine, yet it is as precise and effective as the portable typewriter. It is complete and compact. No scales, triangles, thumbtacks or T-square—a pencil and compass are all you need.

Investigate this modern way to increase the efficiency of your designers and draftsmen. Write for detailed information.

No. 10-H takes 9" x 12" sheets\$4.50
No. 15-H takes 10" x 15" sheets 6.25
No. 20-V-6-8 takes 12" x 18" sheets 9.75

THE DRAFTO COMPANY
110 Walnut St., Cochranton, Pa.

SHELDON BACK GEARED SCREW CUTTING Precision Lathes

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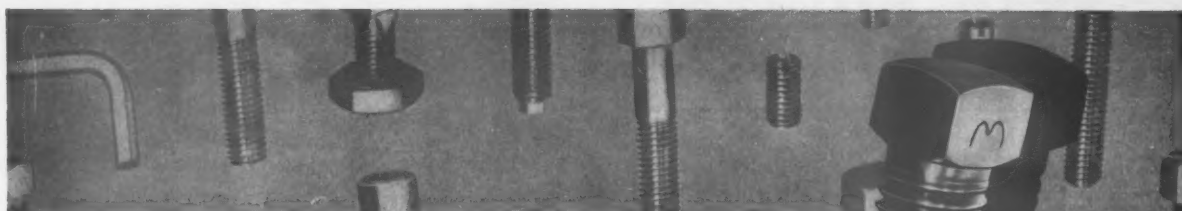
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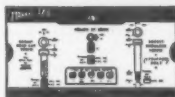


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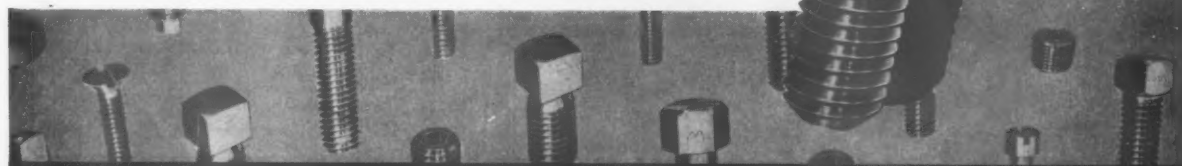
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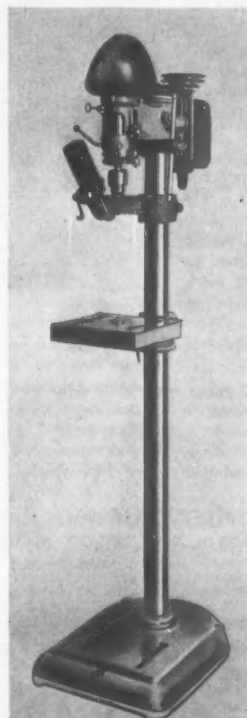
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January Meetings

BOSTON—Jan. 9. Dinner 6:15, Smith House, Memorial Drive, Cambridge. Technical Session, Room 6-120 Eastman Building, M. I. T. Anthony J. Snyder, Director of Physical Testing Laboratory, Morse Twist Drill and Machine Company, New Bedford, Mass., will speak on "The Proper Selection and Use of Tools."

CLEVELAND—Jan. 10. 6:30 at The Weatherhead Company. Major H. M. Reedall, U. S. A., Executive Officer Cleveland Ordnance District will speak on "What is Being Done on National De-

fense." Reservation: Wm. Reiff, Main 0112.

GREATER NEW YORK—Jan. 24. First Annual Dinner-Dance, Terrace Restaurant, LaGuardia Airport. Table-side entertainment, Inspection tours through airport, Ringside view of airport activities, Kitty Hawk cocktail lounge, Drawing for night flight over N. Y. City. Reservations \$4.00 per plate payable in advance to Secretary.

HARTFORD—Jan. 6. Technical Session, 8:00. Hartford Gas Auditorium,

Pearl Street. Mr. W. C. DeGraff, Tool Engineer for Warner & Swasey, will speak on "Turret Lathe Tooling." Reservation: James N. Skinner, Skinner Chuck Co.

HOUSTON—Jan. 9. Dinner at River Oaks Country Club. Joint meeting with American Society of Metals. A. H. d'Arcomb, president of A.S.T.E., will speak on "Machinability of Metals."

INDIANAPOLIS—Jan. 30. 7:00, Hotel Warren, S. Illinois St. Major A. C. Rasmussen, Ordnance Reserves, will speak on "Industrial Mobilization." Reservation: R. D. Harris, 4201 East 35th Street.

MILWAUKEE—Jan. 9. Dinner 6:30, Technical Session 7:30. Place to be announced. Dr. Ernest J. Abbot will speak on "Surface Finish and the Profilometer."

NEW YORK-NEW JERSEY—Jan. 14. Technical Session 8:00. Robert Treat Hotel, Newark. Mr. James R. Longwell will speak on "Steel Cutting with Carbide Tools." Motion picture: "A Trip Through Florida."

PEORIA—Jan. 7. Dinner 6:30. Endres Hotel. Mr. James R. Longwell will speak on "Steel Cutting with Carbide Tools." Reservation: Mr. Everett C. Bowton, 412 Thrush Avenue. Phone 2-6984.

PITTSBURGH—Jan. 3. Dinner 6:30, \$1.00. Technical Session 8:30. Stouffer's Restaurant, Wood & Diamond Streets. E. G. Koch, Bausch & Lomb Optical Company, will speak on "Newer Types of Optical Instruments Applied to Industry."

ROCKFORD—Jan. 9. Dinner, 6:00. Hotel Faust. W. P. Schmitter, Falk Corporation, will speak on "Helical Gear Applications." Reservation: Allis-Chalmers, Main 6270.

SCHENECTADY—Jan. 13. Dinner 6:30. Danish Hall, 989 Albany Street. E. V. Crane, Engineer and Consultant, Bliss Co., will speak on Punches and Dies. Reservation: Harry Crump, Works Laboratory, G. E. Co.

ST. LOUIS—Jan. 9. Technical Session 8:30. Engineers Club, 4359 Lindell Blvd. W. H. Wills will speak on the manufacture of high speed steels.

SYRACUSE—Jan. 14. Dinner 6:30, Technical Session 8:00. Syracuse Industrial Club. E. V. Crane, engineer and consultant, Bliss Co., will speak on Punches and Dies.

TOLEDO—Jan. 14. Dinner 6:30. Toledo Yacht Club. Round table discussion of questions on Tool Engineering. Reservation: R. H. Mogle, 3722 Leybourne Ave. Phone La 8783.

TRI-CITIES—Jan. 8. Dinner 6:30. LeClaire Hotel, Moline, Illinois. J. D. Trethaway, Sales Manager, Cerro De Pasco Copper Corp., will speak on the "Uses and Application of Cerro Matrix, Cerro Base, and Cerro Bend."

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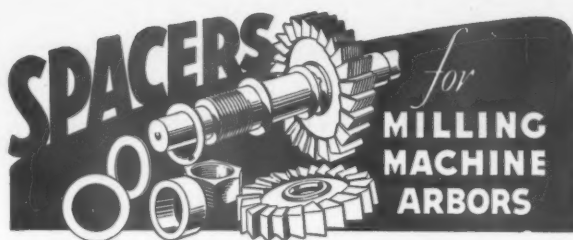
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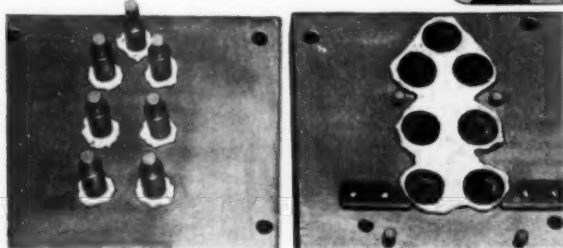
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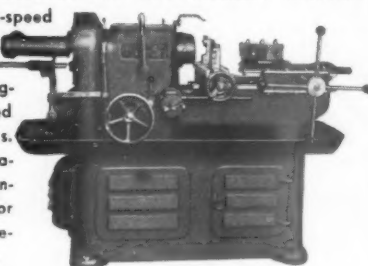
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THE TOOL ENGINEER

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May, 1940 through December, 1940

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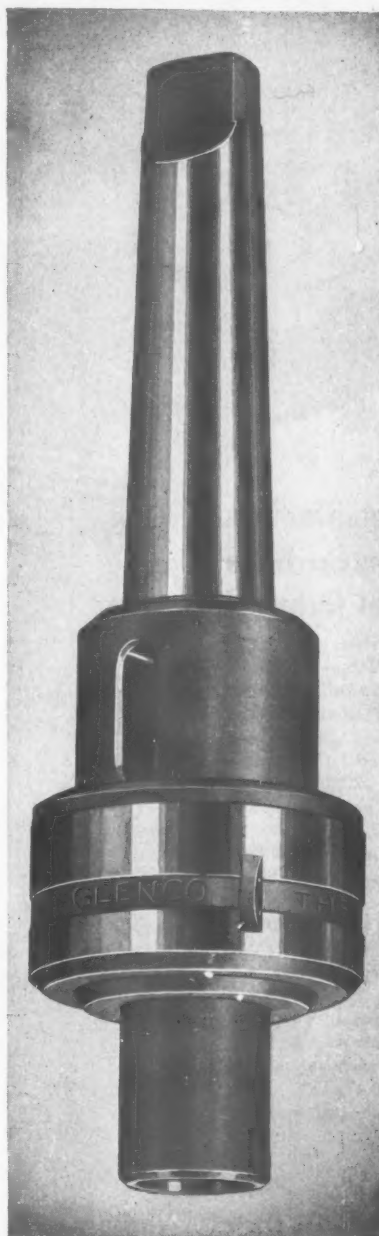
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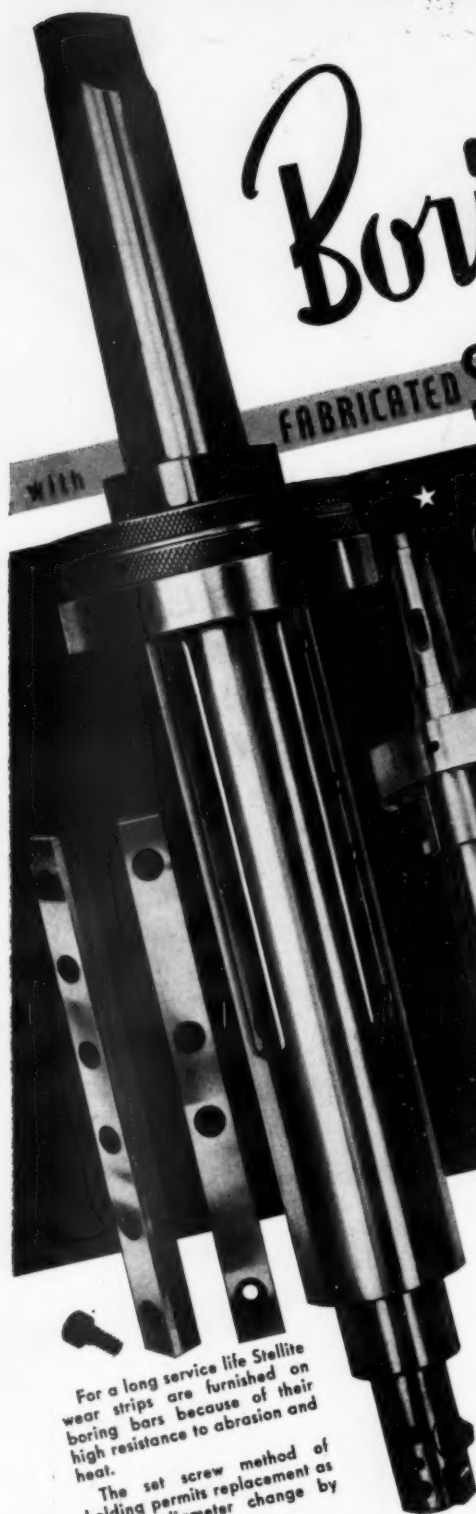


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